S. W. HAYTER

NEW WAYS

OF

GRAVURE

25 DIAGRAMS
100 ILLUSTRATIONS

PREFACE BY HERBERT READ

ROUTLEDGE & KEGAN PAUL LIMITED

CONTENTS

IMPLICATIONS OF GRAVURE AS A SPECIFIC MEDIUM

LIST OF ILLUSTRATIONS

8

11

12

ACKNOWLEDGEMENTS

PREFACE
BY
HERBERT READ

MONG contemporary artists Stanley William Hayter has a wide influence which is due to two distinctive features. In the first place he has revived the workshop conception of the artist—the artist, not as a lone wolf howling on the fringes of an indifferent society, but as a member of a group of artists working together, pooling their ideas, communicating to one another their discoveries and achievements. In the second place, he is an artist with a philosophy, a philosophy that assigns a particular function to art in life, and to the artist in the life of society.

He has selected as his main medium of expression the Cinderella of the arts—the process of gravure, including in that generic term all forms of art which get their effect from the incision of a groove on some resistant material. It thus includes Dry Point and Mezzotint, Burin Engraving and all forms of Etching. Gravure in this sense was not always a neglected medium—the stature of Dürer, Rembrandt, Goya, and Blake, to mention only four great artists, would be sensibly diminished if we were to exclude their engraved work. But, for reasons which Mr. Hayter investigates in the second section of his book, the art fell on evil days—it began to be regarded as a means of reproduc-

tion rather than as an original medium of expression. With the introduction of mechanical methods of reproduction in the nineteenth century, even this use of the medium fell into decay.

It is true that during the second half of the nineteenth century the art of etching revived with Seymour Haden and Whistler, and I am sure the author of this book would be the last man to despise the skill of etchers like Cameron, Muirhead Bone and Zorn. They lacked, however, what he calls "an adequate motive," and this brings us to Mr. Hayter's philosophy.

In the long historical perspective of art one truth emerges clearly: skill is not enough. One hears that today there is a slump in the market for etchings—meaning the market for Frank Short and William Strang, Fitton and Haig, Burridge, Brangwyn and Bone. There is no slump in the market for Rembrandt, Goya or Blake, and the reason does not lie in the superior skill of these artists. It lies in their philosophy, which led them to believe that art was something more than a reflection, however subtle, of the phenomenal world—that it is in some sense epiphenomenal. We can say that art is a criticism of life, and the etchings of Rembrandt are criticism in that sense. But Hayter goes beyond even this degree of the epiphenomenal. In common with the great masters of the modern movement in art—Picasso, Klee, Moore —he believes that the objects of art constitute a distinct order of reality. "I want to distinguish the pursuit of reality from the pursuit of objects," he writes, "to combine immediate experience with experience of the imagination"; and imaginative experience, he realizes, has depths and dimensions that extend beyond the individual, that are racial and archetypal and only to be expressed in symbolic form.

All this Mr. Hayter himself makes clear enough in the pages that follow. He also makes clear another point which cannot be too frequently emphasized—the point that the artist, in his pursuit of reality, is using certain instruments, certain materials; and that the success of his pursuit depends on his exploitation of these means. There has always been an intimate connection between the functioning of the plastic imagination and the manipulation of the plastic means. Poetry is not born ready-made; it is made in the process of birth, and the images spring from the plastic stress itself, from the wrestling with words. The same is true of music and painting, of any art. From this point of view one might say that the art of gravure, before the founda-

16

tion of Atelier 17, was an art that had never realized half its potentialities. Hayter and his pupils have discovered new processes and new possibilities in existing processes; they have added new "values" to the art—values of texture, of dimension, one might even say of color. These are all clearly described in this book—described with a technical enthusiasm and precision of detail which will inspire those who have never engraved before to acquire the necessary equipment, and those who are already practiced in the art to develop new phases of creative activity.

INTRODUCTION

ORIGINS

NGRAVING, the act of incising a groove
into some resistant material, is
found as early as the first traces of
human activity. Perhaps before speech had reached the point of de-
velopment when it could adequately impart command or describe ex-
perience, the scratching of lines into bone, horn and stone served as a
means of communicating ideas and recording experience. If we may
suppose that the first experience of a line, as a thing to be drawn, as a
record of a movement, could have been the trace of the passage of man
or animal on a sand or mud surface (Fig. 103), the action of making a
groove or a line of pits (as footprints) in a more resistant surface
might be one of the earliest methods of recording experience, or ob-
taining the power to re-live an event. The action necessary to incise a
trace in hard material involves, even at this point, driving a sharp in-
strument in the direction of the movement—rather than drawing (pull-
ing) it—so that the "geometric" simplicity of curvature, caused by
the product of two factors only, the impact of the tool and the resist-
ance of the material, is found as unmistakably in prehistoric engraving
(Figs. 64, 104) as in the cut we make with the burin today.

The viewpoint of this book differs in many ways from the traditional
attitude toward the processes of gravure (which normally emphasizes

18

the function of reproduction), not so much as to the fact that a number of identical prints may be made from the plate, but as to its use for reproduction in the sense of a translation from originals created in another medium. Although engraving and etching with related processes are rarely used today for the commercial reproduction of works of art (such as paintings), the photomechanical process having proved cheaper and adequate to the popular taste in such matters, yet even in the minds of artists there remains the connection with reproduction; in recent times the reproduction of a drawing together with his signature has satisfied many an artist as an activity subsidiary to his primary purpose as painter or sculptor. Commercially it has enabled dealers to put on sale specimens of the hand of the artist, less expensive than original and unique drawings, but which could be considered in some degree as original works of the artist. The distinction between prints invented, executed on plates, and printed by the artist himself, and those cut by an artisan and printed by a specialist, has been lost to some extent.

My own conviction is that engraving and the related techniques constitute a very valuable medium for original expression. They have many features in common with the arts of design, painting, and sculpture, but possess certain resources of their own, together with certain definite limitations, the latter being by no means those that have been accepted traditionally for the last few centuries. It is, for instance, possible to produce in a print from a plate any conceivable texture, quality, or effect obtainable in drawing with ink, pencil, crayon, wash, or even by means of a woodcut, wood engraving, or lithograph. To what extent this is desirable is, of course, another matter. Beyond these resources of the medium there are countless untried ways of exploiting effects to be produced by the actual methods of preparing a plate: the action of mordants, or acids in etching, the unequal resistance of grounds to attack by acids, the sensitivity of soft wax to pressure, of abrasives in effecting variations in the printing surface, besides the action of the cutting, scraping and polishing tools in dry point and mezzotint work. The etching and engraving techniques have an enormous potential vocabulary of expression, the greater part of which is practically unknown; until very recently only a few exceptional artists have employed it at all, and then only at long intervals.

I hope in this book to indicate the directions in which this vocabulary

19

of expression may be amplified, without pretending to set limits to their extension in the future.

The invention of a method of execution calls mostly for ingenuity, and any generation can produce the appropriate inventions, if the need for them is sufficiently urgent. The development of new techniques of engraving and etching in the last twenty years bears no witness to the real capacities of those concerned in it; the demand was lacking. Compared with the fantastic growth of techniques in the natural sciences in the last century, their achievement is indeed quite modest. It has been the fashion to divorce the arts from scientific development, but I feel that this is an error. The activity of the artist, like that of the philosopher, embraces every action of the human spirit; the methods by which advances in technique and domination over scientific fact are made are very similar to the methods of the artist. Man rediscovers rather than creates; the unconscious activity of research depends on the recognition of a pattern previously established in the mind of the researcher.

Since the nineteenth century man's increasing consciousness of and power over space (in physics and mathematics) has been reflected in new and unorthodox methods of demonstrating space and time graphically. The "picture plane," a sort of window (Fig. 1), that theoretical surface behind which one might produce the illusion of timeless and unmoving space, was attacked from several angles. In some cases elements were made to pass through this plane, or to appear before it, such as the cut-out relief forms of Arp, or the *collages* of Picasso and Miró. In other cases the complete *raison d'être* of the picture was suspended in it; in still others an attempt was made to destroy the "window" entirely. Attention which had been concentrated upon the objects and their representation, was transferred to the relationship between the objects and their movement in space. Many properties of matter and space, which had been represented diagrammatically only by the scientist, found their expression in graphic and affective forms. The new aspects of psychology suggested to the modern painter a fresh sense of his relationship to his work, of its function and of its significance to the rest of humanity.

Particularly in engraving, which is essentially the art of the line, of the line in three-dimensional space, it became necessary to exploit the enormous possibilities of indicating the properties of matter, force,

20
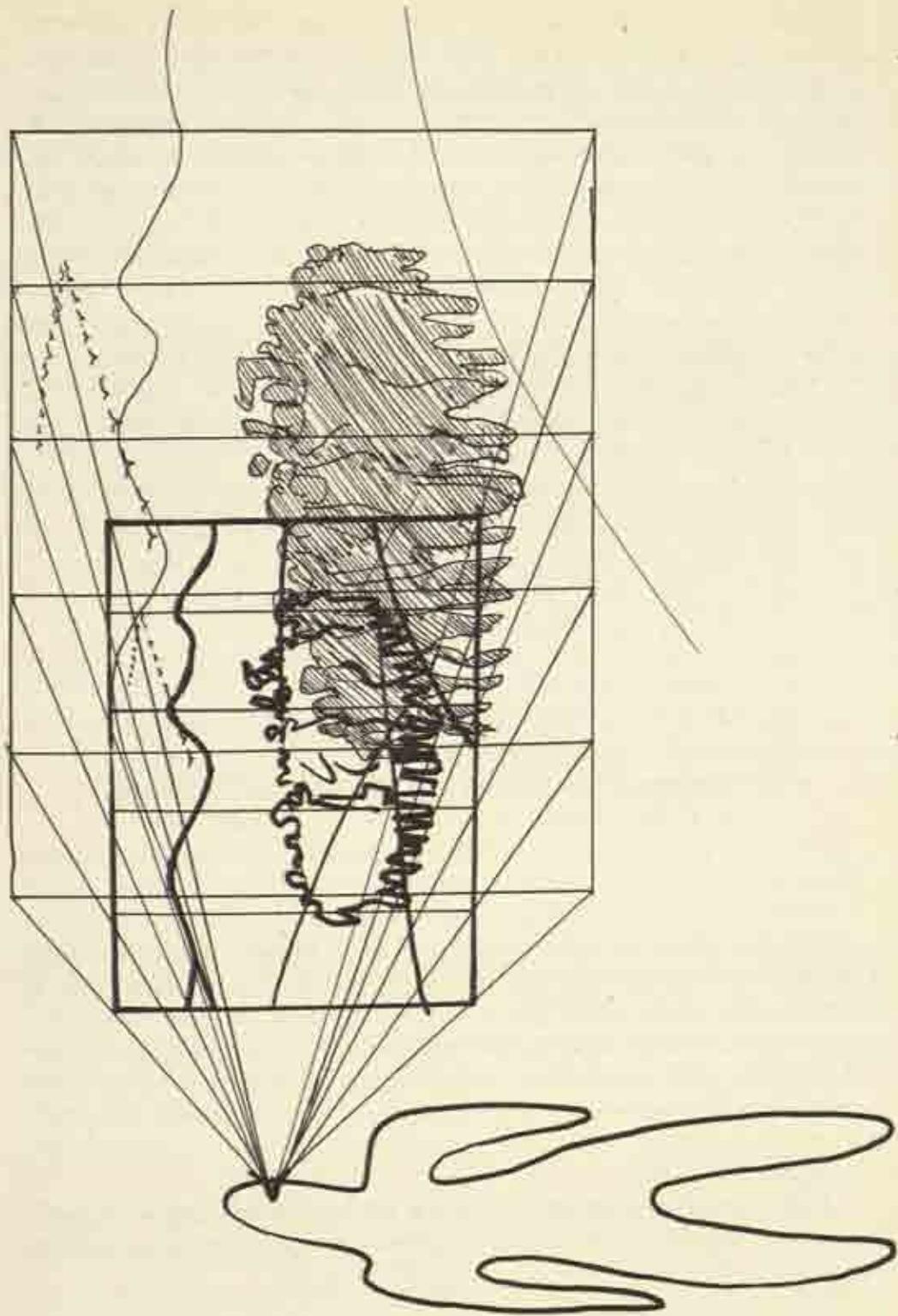
Fig. 1. "Window" Picture-Plane

motion, and space. In the methods of etching, the arrangement of transparent webs to define planes other than the picture plane, often no longer parallel to it, of surfaces having tension or torsion, and the interpenetration of transparent surfaces, could more easily be realized than in the usual techniques of painting. By means of the hollowing-out of spaces in the plates (or drilling holes through them) a projection could be made in front of the picture plane of the print, in this case represented by the unworked surface of the plate. Prints made

Fig. 2. German School (15th Century): Triumph of Chastity. Niello

from fifteenth-century plates intended to decorate boxes show in the four corners the white relief projections caused by the rivet holes by which the plate would have been secured (Fig. 2 shows such a rivet hole at the top of the plate); such prints were accessible to artists over a period of four centuries, but it is not surprising that the effect was never used by them. Until the historical necessity for breaking through the picture plane arose, such effects not only were of little value to the artist, they were definitely undesirable. But when it became necessary to use this device for artistic expression, the method to produce the effect was at hand.

In the practical part of this book I propose to describe as exhaustively as possible what is done to obtain a plate which is to produce

22

certain qualities when printed. In that part, however, which deals with techniques of expression and projection (which will inevitably become involved to some extent with techniques of thought and methods of access to the imagination) an assumption will be made which should be defined right here. I intend to assume that there exists a general truth, as a common value beyond the control of individual desire or speculation; but that objects, things in the phenomenal world, have an order of reality which is less concrete than the reality of a human re-action to them. And I want to distinguish the pursuit of reality (the reality of the first order) from the pursuit of objects, and to combine the immediate experience with the experience of the imagination, which I should like to consider as the trace or record of assimilated previous experience, not necessarily restricted to the immediate lifetime of the individual.

TECHNIQUES

CHAPTER

1

WORKSHOP PLANNING - MATERIALS AND EQUIPMENT - PREPARATION OF THE PLATE

LAYOUT OF THE WORKSHOP

For convenience of working in plate media three areas should be allocated in the available space:

a) Work Room: Room for drawing, working on plates with needles, burins and other tools, for stopping out, etc.

b) Etching Room: Space screened off or remote from the room above, equipped with running water and furnished with acids and acid baths near the window or ventilation, heater for laying grounds and, as far away from it as possible, a cleaning table with a fire extinguisher near to it.

c) Press Room: The printing room, with press, hotplate, inking slab, another glass or marble slab for grinding ink, tables carrying wet paper pressed between glass slabs, blotters for drying prints, and a cord for hanging up blankets to dry.

The ideal arrangement would be three separate connecting rooms so that one could pass from the work room to either the etching room or the press room, and for wetting paper and cleaning plates from the press room to the etching room. The plan (Fig. 3) has been drawn for a single room with partitions to isolate the etching room from the remaining space, as this sufficiently demonstrates the requirements.

a) Work Room: This space must have at least one large, extremely firm table with good light from a window, or artificial light falling upon the working position, from the left side. A diffused light is prefer-
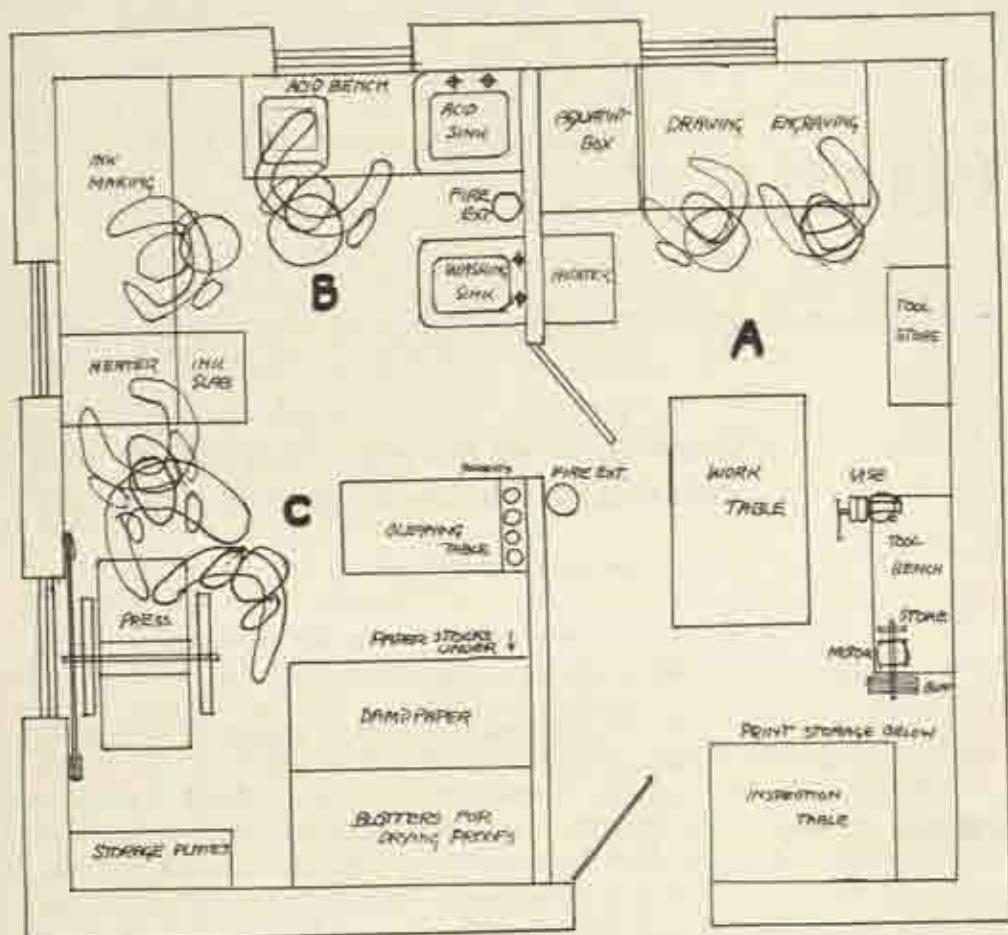
Fig. 3. Layout of Workshop, 18' x 20'

able to avoid any glare from the plate surface, and to make work through grounds more visible. Near to the table, racks and storage space must be provided for tools, stones, brushes and varnishes. A separate table, not to be used for work, for handling proofs, and a cabinet with deep drawers in which to store prints are also useful.

b) Etching Room: The place where acids are to be used must be well ventilated, as nitric oxide, hydrogen, chlorine and solvent vapors

28

are given off during the operations. A draining table leading to a sink is a convenient place for the acid baths. This should be coated with asphaltum or other acid-proof material. A second sink is very useful if much work is to be done; this should be kept scrupulously clean and reserved for wetting paper and cleaning plates and hands. If the cleaning table, preferably glass-topped for cleanliness, is in this section, it should be as far as possible from acids, as the spray from them will affect plates and tools, and from flame or heaters. One of the fire extinguishers should be over this table. Storage is provided near the sinks for acid bottles, acid baths, ammonia, whiting, water stone, charcoal and abrasives. A good light is needed over the sinks for cleaning, to control biting, and for grinding.

c) *Press Room:* This is so organized that the printer shall use the minimum number of steps while working. The hotplate with the inking slab should be at the right; then, towards the left, the bed of the press, the wet paper, and the blotters for drying prints. It should be possible to reach the bed of the press from the hotplate by turning around and taking no more than two paces. In the arrangements shown, the hotplate, the inking slab and the gauze pads, blotters and wet paper, form, with the press, three sides of a square in which the printer moves, the fourth side being occupied by a window. Thus the light falls from the left while the plate is being prepared. It is then placed on the press, wet paper is laid upon it with clips, blankets are laid down and the press is turned. Then the proof is lifted and placed in the blotters, and the plate is returned to the hotplate for re-inking. If the exit from the press room is near to the sink for cleaning and for wetting papers, this is convenient. Though light is needed on the plate being inked and on the press for the placing of the sheet, the paper table needs less, as proofs can, if necessary, be examined on the bed of the press. Storage must be provided for inks, ink-making materials, oils, pigments, mullers and so on, remote from the press; it must also be supplied for paper, which can be stowed beneath the tables, and for blankets and the cleaning rags for the press.

MATERIALS AND EQUIPMENT

Plates

The plates are of copper or zinc, 16 or 18 gauge, rolled, or hammered as hard as possible. Copper which has been recently heated and cooled

is soft, and the crystallization of the metal has to be re-established by hammering or rolling. If the plate is hammered the crystallization is established in all directions, if rolled, in the direction of the passage of the plate. A rolled plate, however, if left untouched for many years, becomes as hard as a hammered one. This crystalline structure is important as it is exposed by certain manners of etching and also affects the cutting of a burin. At one time plates were scraped by hand with a sort of adze which removed a long ribbon of metal from one end to the other; they were then ground level and finished with a buff and jeweler's rouge paste; today they are ground mechanically to a level, often by a machine holding water stones in a device like a human arm with two rods connecting the holder to a single rod moving up and down the plate.

In France, Atelier 17 used plates which were slightly dulled as this was found to avoid glare, to give grounds a better hold and to permit drawing on the surface with a pencil. In the United States, where these depolished plates are not available, we sometimes sponge the plates with ammonia, or etch them for about a minute in Dutch mordant.

Abrasives

Carborundum powder, No. 150; used for roughing up the surface of a plate and, with a flatiron, for the carbograph method as mezzotint; also used for roughing glass slab for ink grinding, and for preparing the muller.

Rotten-stone powder, for repolishing plates.

Water of Ayr stone (Scotch hone), used with water for replaning the surface of the plate.

Snake-stone, used as above, leaving a smoother surface.

Willow charcoal, used after or instead of the snake-stone as the second stage of repolishing a plate.

Emery paper, Nos. 0000 and 000000, used in the final stage of repolishing a plate, and in repolishing burnishers and scraper faces.

Putz pomade, rouge and tallow, used with an oil rubber of rolled felt or canvas for finishing a plate to a mirror surface.

Emery wheel and buff, driven by ¼ h.p. electric motor, for regrinding and repolishing plates and tools by mechanical means rather than by hand as above.

India oil-stone (Norton list No. 1B64), having fine and coarse sides, for sharpening tools.
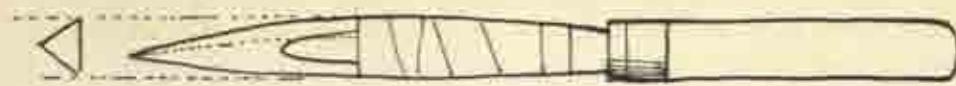
SCRAPER

A
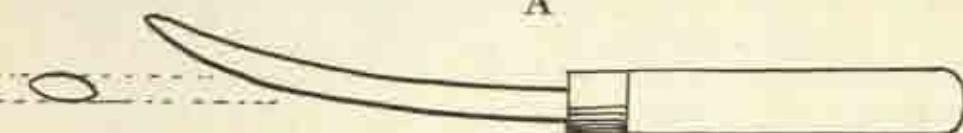
BURNISHER

B
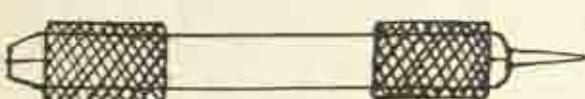
PIN VISE

C
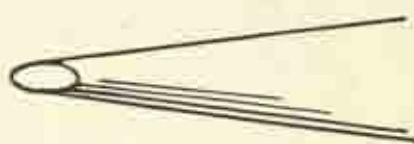
ECHOPPE [ENLARGED]

D

45°

30°
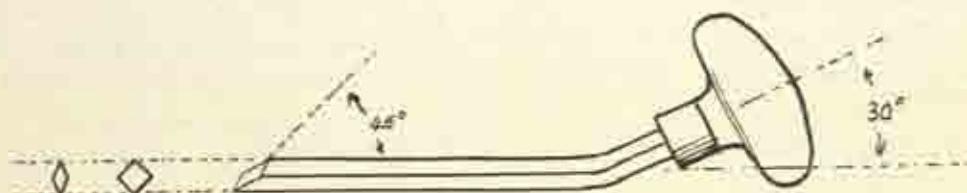
BURIN

E

SCORPER

F

Fig. 4. Tools: (A) Scraper—(B) Burnisher—(C) Pin Vise—(D) Echoppe
(E) Burin—(F) Scorper

Wire brush, for cleaning lines and, in *manière noire* etching and dry point, for scratching plates.

Tools

Files for beveling edges of plates.

Sprayer for fixative or air-brush; used in aquatint and bitten-surface etching to stop gradations.

Scraper, triangular section, for removing errors, and producing certain textures on the plate surface (Fig. 4A).

Burnishers, of steel or agate, of spoon or conical form, for repolishing corrections or lightening surfaces in the plate in aquatint, bitten-surface or mezzotint (Fig. 4B).

Pin vise (to hold tools from 0 to ⅛ inch), for phonograph needles or other small tools (Fig. 4C).

Hand-vise, for handling plate while hot.

Bench-vise, for tool making.

Needles and points of various sizes.

Echoppe, a needle ground to a diagonal face to give a cutting edge, for re-needling across worked surfaces (Fig. 4D).

Stylus of bone, wood, cactus, etc., for working through soft grounds.

Leather comb and steel comb, sometimes used to work through soft or hard grounds.

Burins, square or lozenge-section, sizes from 7 to 10 (Muller), for line engraving on copper (Fig. 4E).

Scorpers, half-round and square section, sizes from 54 to 63, for removing hollows to print as raised whites on the proof, or to produce certain textures and qualities on the plate (Fig. 4F).

Rollers

Wooden rollers, covered with felt or carpet, used in inking intaglio plates. These should be sealed or kept in linseed oil to avoid hardening.

Hard rubber rollers, used to replace leather rollers in laying grounds, and for certain ways of printing from the surface.

Soft rubber rollers, preferably synthetic to resist heat, also used for inking and for laying grounds.

Gelatine rollers (brayers), for typographical printing.

Leather-over-felt-over-wood rollers for laying grounds, separate rollers being kept for hard and for soft grounds.

Dabbers (tampons) of rolled rag, or wash leather stuffed with cotton, used to replace the rollers for both inking and laying grounds.

32

Press

Blankets, finest pure wool woven roller cloth, sizes for plates to be printed, in sets of three or four. One of each set to be very close woven (fine "swan-cloth"), as it will determine the texture of the print.

Blotters, white, of sufficient size for drying prints, paper for printing, plates, etc., 24 inches by 40 inches is a good size.

Starched tarlatan to remove ink from the plate in printing intaglio; it should have no grit and not be hard enough to scratch the plate.

Cotton gauze, unstarched, for *retroussage* in printing.

Wax paper, to protect felts in transferring texture to soft-grounded plates, and to wrap plates for storage.

Tissue paper, white, to place between proofs in drying and storage.

Glass slabs, preferably 1 inch thick, or a box lined with stainless steel or zinc for pressing wet paper.

Sponges, for wetting paper.

Brushes, one soft for brushing paper surface, and another for cleaning ink out of lines in plates.

Whiting, in block and powder; block for cleaning hands in wiping plate; the powder for degreasing plates with ammonia before laying hard ground.

Inks

Glass or marble slab (or litho stone) for grinding inks. The surface should be ground with carborundum at times to keep a tooth on it.

Glass or granite muller, for grinding ink. Its surface also should be ground at times.

Cone grinder, driven by hand or, if electric, with slow speed. This replaces the hand-grinding of ink only if used carefully to avoid heating by too much friction.

Raw cold-pressed linseed oil for ink-making.

Plate oil (burnt linseed oil) for intaglio ink. This oil is made by heating raw linseed oil at its boiling point for four to six hours when a violent oxidation occurs during which the oil usually takes fire spontaneously. When cool it is greenish in color, very viscous, and has a characteristic smell of acrylic acid.

Litho-varnish, slow drying, used to give consistency and transparency to colors in surface printing.

Sun-thickened oil, Venice turpentine, siccative (manganese or cobalt), used in inks for different purposes.

33

Pigments

Frankfort black, used in making ink for intaglio, is a light pigment with great absorption of oil, made from calcined wine lees, containing considerable iron salts.

Noir bouju (French black), a very dense pigment, mixed with Frankfort to make black for intaglio.

Fine vine black, similar to *bouju,* used to replace it.

Lamp black, used in making ink for surface printing.

Various powder colors, for grinding inks for intaglio and surface printing.

Grounds

Stopping-out varnish, a saturated solution of resin in alcohol, used for recovering the plate in etching.

Asphaltum solution in turpentine, benzene, or lacquer solvent, used for recovering where a very long bite is needed.

Gilsonite powder (dry asphaltum), used in making grounds and varnish.

Beeswax, used in making grounds and in edging big plates.

Axle-grease or tallow, used in making soft grounds.

Colophony resin (damar or mastic), used in making grounds, in powder for aquatint, and varnishes.

Hard ground, made from asphaltum, beeswax and resin, for coating plates for etching; often smoked to harden.

Soft ground, made from hard ground with $\frac{1}{4}$ to $\frac{1}{2}$ quantity of tallow or grease, or for certain purposes from wax, resin and grease only. Used for transferring pencil trace, direct drawing with stylus, or impressions of textures for etching.

Solvents

Gasoline for removing grounds, varnish, or inks from plates and cleaning press, hotplates, etc.

Benzene, turpentine, alcohol, chloroform, ether, acetone, lacquer solvents, kerosene, for removing grounds, etc., and making liquid grounds, varnishes, etc.

Lye (caustic soda solution) for removing dried-in ink from plates.

Syrup, sugar solution, glycerine, gamboge, gum arabic, soap, for making lift grounds; they prevent the adhesion of a ground to the plate and cause it to lift with warm water.

Acids

Nitric acid (HNO_3), mixed with 2 parts of water and some copper in solution for etching copper, or mixed with 10 to 12 parts of water for etching zinc.

Hydrochloric acid (muriatic acid: HCl), used with a saturated solution of potassium chlorate for etching copper.

Potassium chlorate ($KClO_3$).

Dutch mordant, a solution of potassium chlorate with 10 per cent hydrochloric acid, for etching very accurate work on copper.

Ferric perchloride ($FeCl_3$), in solution in water, used for etching copper.

Glass-stoppered bottles for storage of acids.

Hard-rubber, glass, porcelain or enamel acid-baths. The latter will only resist acids if the surface is intact.

Rags for cleaning and polishing.

A few addresses of supply houses both in the U. S. and Great Britain might prove useful to the student:

In the United States all tools and materials may be obtained from any artists' material store or jewellers' supply house. E. C. Muller, Engravers' Tools, 61-63 Frankfort Street, New York 7, N. Y., and The Cronite Co., Inc., 35 Park Place, New York 7, N. Y., carry everything needed by the graphic artist. Special addresses of dealers in rolled and hammered plates are mentioned in Chapter 3, page 55.

In Great Britain the following specialize in supplies:

Kimbers Supply Service — Process Materials
44 Clerkenwell Green
London, E. C. 1
  (carries everything)

C. Roberson & Co.
71 Parkway
London, N. W. 1
  (tools, copperplates, grounds, etc.)

T. N. Lawrence
4-7 Red Lion Court
London, E. C. 4
  (tools, copperplates, inks)

Buck & Ryan Co.
310 Euston Road
London, N. W. 1
  (gravers and tools)

Fig. 5. Alexander Alexeieff: Illustration for Gogol's *Ioyrnal d'un Fou*, 1927. Engraving and Aquatint.

CHAPTER

2

DRY POINT AND MEZZOTINT

DRY POINT

Perhaps because of its apparent simplicity, dry point—the direct scratch of a point on a metal plate—is often the first method attempted by the beginner. The tools and the equipment needed are few and not elaborate: a plate, a point, and the means of printing. As I shall explain, however, the apparent simplicity of the medium is illusory. The degree of manual dexterity demanded is higher than that asked by any method except line engraving, and considerable experience is required before results can be foreseen.

As has been shown in the introduction, intaglio printing is normally made from grooves or pits in the plate so that the ink stands up in relief above the surface of the print. In dry point, however, the actual part played by the groove which the needle makes is insignificant. The burrs, those flanges of metal turned up at the edge of the scratch, are chiefly responsible for retaining ink upon the surface of the plate when it is prepared for printing. Thus, when pressed into paper, the lines will *not* be visible in relief above the surface.

A dry point print can usually be identified under a magnifying glass

37

Fig. 6. Joseph Hecht: Collioure, c. 1920. Dry Point

by the *indentation* made by the burr in the sheet of paper and by the soft color. This color is due to the fact that the bulk of ink in the lines is less than it is in engraving, and therefore actually appears less black. Furthermore, where the color of the etched and engraved line appears cold, that of the dry point line is warm. The printing methods are the same as those for the printing of intaglio prints, but it is impossible to make surface or relief prints from dry point plates.

Copper plates are most generally used, although brass and steel have also been employed. Zinc, which allows the greatest ease in working, is too soft. Possibly the very hard beryllium-copper alloy would provide an ideal plate for dry point.

To make a plate in dry point

The materials required are a steel, sapphire or diamond point, set in a wooden or metal holder, and a copper plate, scraper and burnisher, as already described. As in all direct printing methods, the proof will be a mirror image of the plate, that is, reversed from left to right.

It may be found convenient to draw or trace on the plate, using a wax pencil, lithographic crayon or tracing through carbon paper. Should the surface of the plate not be too highly polished, an ordinary soft pencil may serve to mark the traces. It has also been found that a drawing made with a ball-point pen can be transferred to the plate, by wetting the paper and passing it, face down on the plate, through the press.

A scratch is made in the surface of the plate with the firmly held point. Should a number of these scratches be examined through a magnifying glass, it will at once be apparent that three quite different lines can be made, which are distinct even when made with the same point and under the same pressure. This is because it is the burr on the edges and not the groove itself which determines the quality and strength of the printed line. The diagram (Fig. 7) shows these three types of line and the characteristic angles between the point and the direction of the line which determines them. To obtain the line shown in No. 3, the heavy, saw-edged burr must be made with the point nearly vertical, otherwise the burr itself will be undercut and removed, giving the line No. 4. The last line of the diagram shows how widely the resistance to wear of these different lines varies. The pressure of the press in printing, which is over 100 lbs. to the square inch, is carried

No. 1   No. 2   No. 3   No. 4

HORIZONTAL
ANGLE TO
DIRECTION
OF LINE

30°

90°
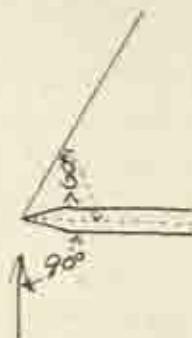
ANY OF
PRECEDING
LINES WITH
BURR REMOVED
OR NO.3 WHEN
POINT BELOW 60°
TO VERTICAL

2 KNIFE EDGE
BURRS

1 KNIFE EDGE
BURR

SAWEDGE
BURR

NO
BURR

SECTION
OF PLATE

EFFECT
ON PRINT

RESISTANCE TO WEAR

GOOD   GOOD   POOR   GOOD

Fig. 7. Four Types of Dry-Point Line

momentarily by these saw points so that it is obvious that they will rapidly be bent down or worn away.

The problems involved in making a dry point which will carry out the artist's intentions exactly mean that the ordinary action of drawing, with the angle between pencil point and paper continually varying, must be forgotten. Either the point must be held firmly and the plate swung to make a curve, or else both hand and point must swing in the curve to be made.

The last type of line (No. 4) does not print very strongly. Its effect is rather gray as the trench is shallow. A diamond or sapphire point, held loosely, gives such a line, making grays like those seen in the sky of *Paysage Urbain* (Fig. 9). The doubled line (No. 1) is also valuable as a means of establishing grays. There is no reason why rulers, or mechanical devices to rule parallel lines, should not be employed if needed, but, in actual practice, I have found no need to use such helps in cutting a straight line.

The progress of the work can be followed by rubbing a little printing ink into the surface and wiping it clear with the palm of the hand. If the plate is examined in a mirror an approximate idea of the appearance of the plate will be obtained.

It is, of course, possible to make textures of kinds other than shading or cross-hatching, although one rarely sees it done. Mauricio Lasansky, the Argentine master, has perfected a method of driving the very sharp point, loosely held at an angle, against its direction, which causes it to skip and make short dashes or dots, the intervals between them being controlled to give a variety of dotted textures. The more acute the angle at which the point is held, the wider will be the interval between the dots (Fig. 10). This effect resembles that of mezzotint, described later, but the textures are variable and are, in general, much bolder.

Should parts of the plate be found to be too dark, or certain lines to have been scratched too violently, these can be lightened by scraping away the burr with the scraper. It is easier to do this when ink is in the lines, as the effect is then immediately visible. When a line has to be removed entirely, this can be done with the burnisher, particularly if no metal has been removed from the plate.

It is not advisable to print any more often than is *absolutely* necessary to verify the quality of the work, as every print made from the

41
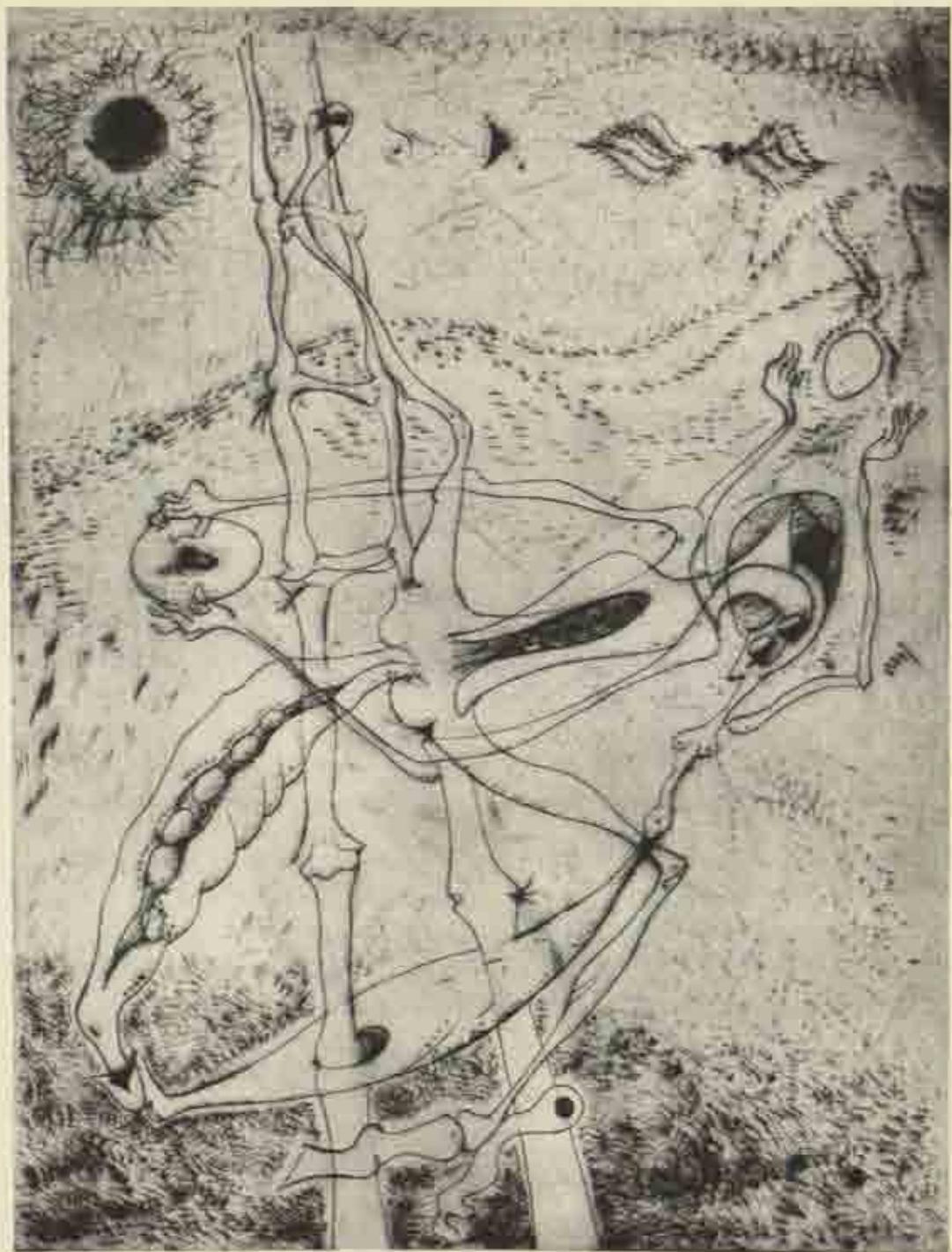
Fig. 8. André Masson: Le Génie de l'Espèce, 1942. Dry Point.
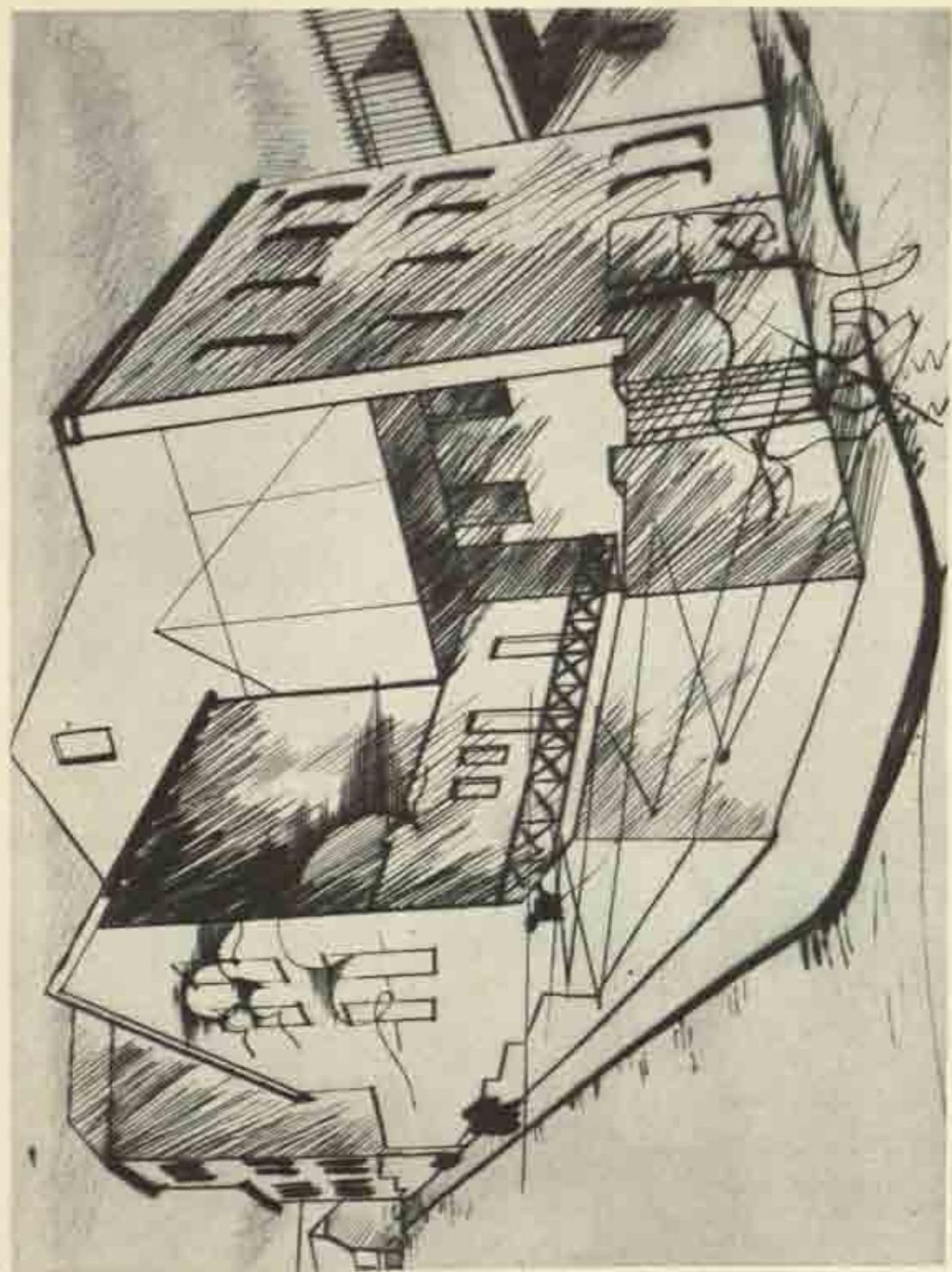
Fig. 9. S. W. Hayter: Paysage Urbain II. 1930. Dry Point

Fig. 10. Mauricio Lasansky: Cancion de Cuña. 1936: Dry Point
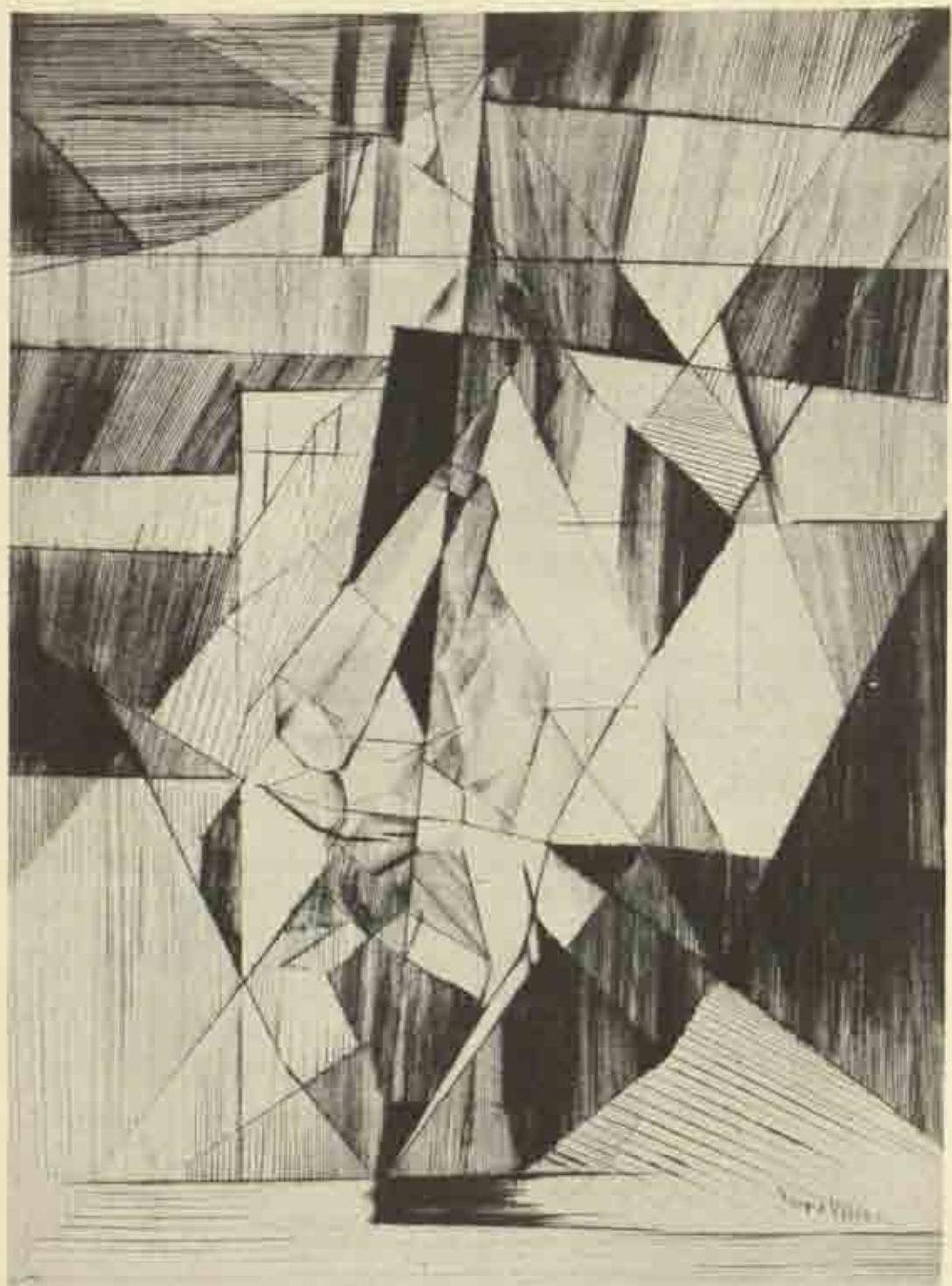
Fig. 11. Jacques Villon: Composition. Dry Point.

plate will alter the plate very slightly and *not uniformly*, owing to the different resistance offered by lines of varying character.

A zinc plate which, owing to its softness, begins to change from the very first print, might, on a well-worked print, give ten prints nearly alike in quality. A well-worked copper plate might give twenty or even thirty, but no more. By the use of a steel or chromium facing it is possible to strengthen the burr so that it will stand up to an edition of 50 to 100 prints, but of all the media used, dry point is the one which suffers most in the process of printing. With experience it is possible to make a plate which, when worn by the first printings and then steel-plated, will produce the desired effect. One should note that no method of printmaking is currently employed with less precision or more uncertainty than dry point, even on the part of the so-called masters.

MEZZOTINT

This method of making prints, invented in the seventeenth century, consists, broadly, of roughening the surface of the plate with a tool so that enough ink can be retained by the surface to print a uniform black. It is clear that this effect could be obtained by cutting dry point lines in two or more directions, close enough together to hold ink between the burrs. The tool used, the rocker (Figs. 12, 13), has a curved blade, the underside of which is cut with fine, closely set grooves. When this is rocked across a plate a series of fine dots, each carrying a small burr, results.

To prepare a plate the rocker is held as shown in Fig. 13 and the surface is covered in one direction, each rocked line being worked as close as possible to the previous one. The position of the plate is then changed and it is worked across again in a direction at right angles to the first. Then diagonals and parallels to the sides, four in all, are worked across; they will generally result in a uniform black. To acquire accuracy in attaining this black considerable practice is required.

Another and simpler method of preparing a plate for the same effect is to work over it with carborundum stone in two or three directions. A group in Philadelphia has also employed carborundum powder worked over the plate with a flatiron.

Then, with scraper and burnisher, the markings are slowly smoothed

46

Fig. 12. Working the Mezzotint Rocker

Fig. 13. Rocker and Roulette
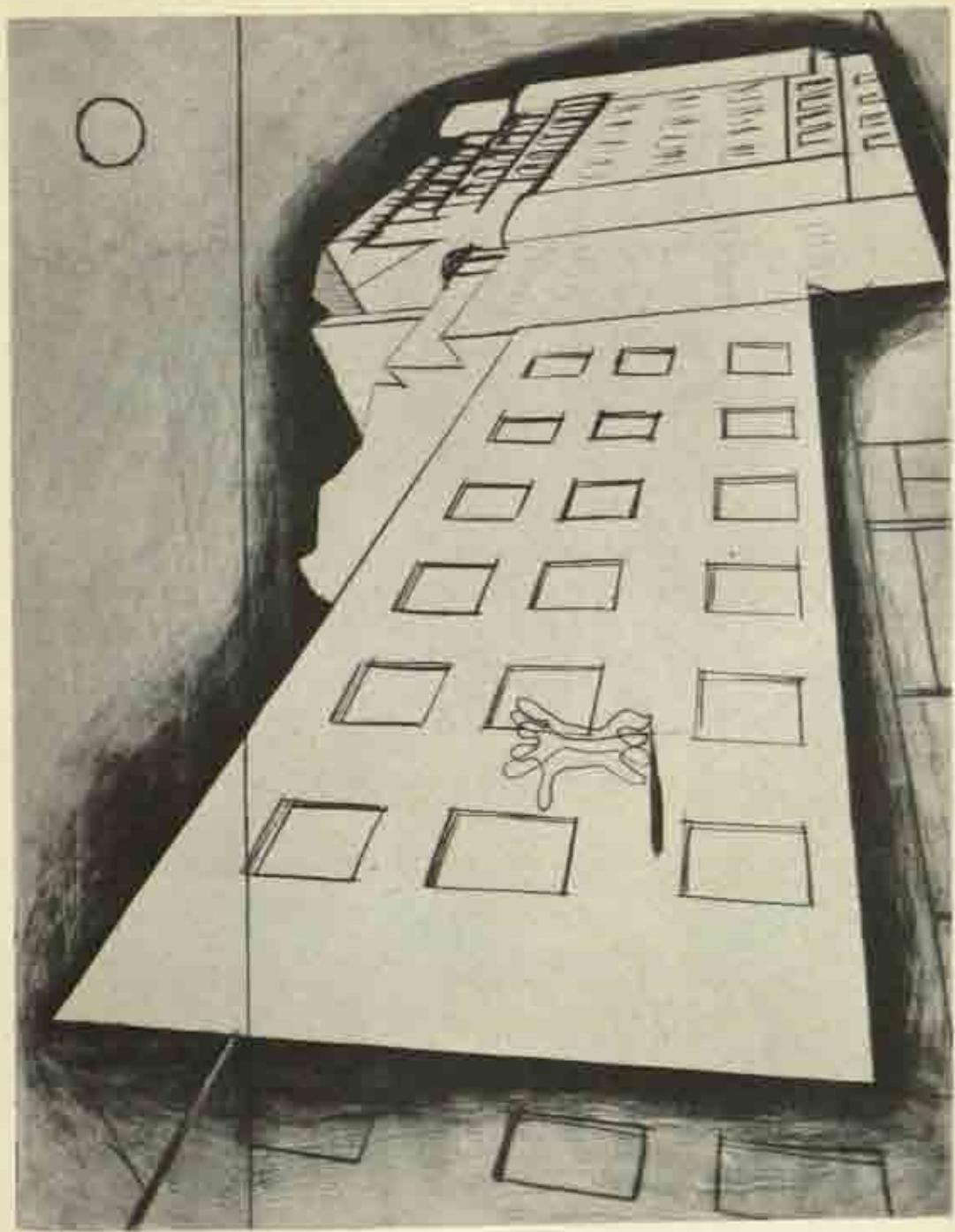
Fig. 14. S. W. Hayter: Paysage Urbain IV, 1929. Mezzotint
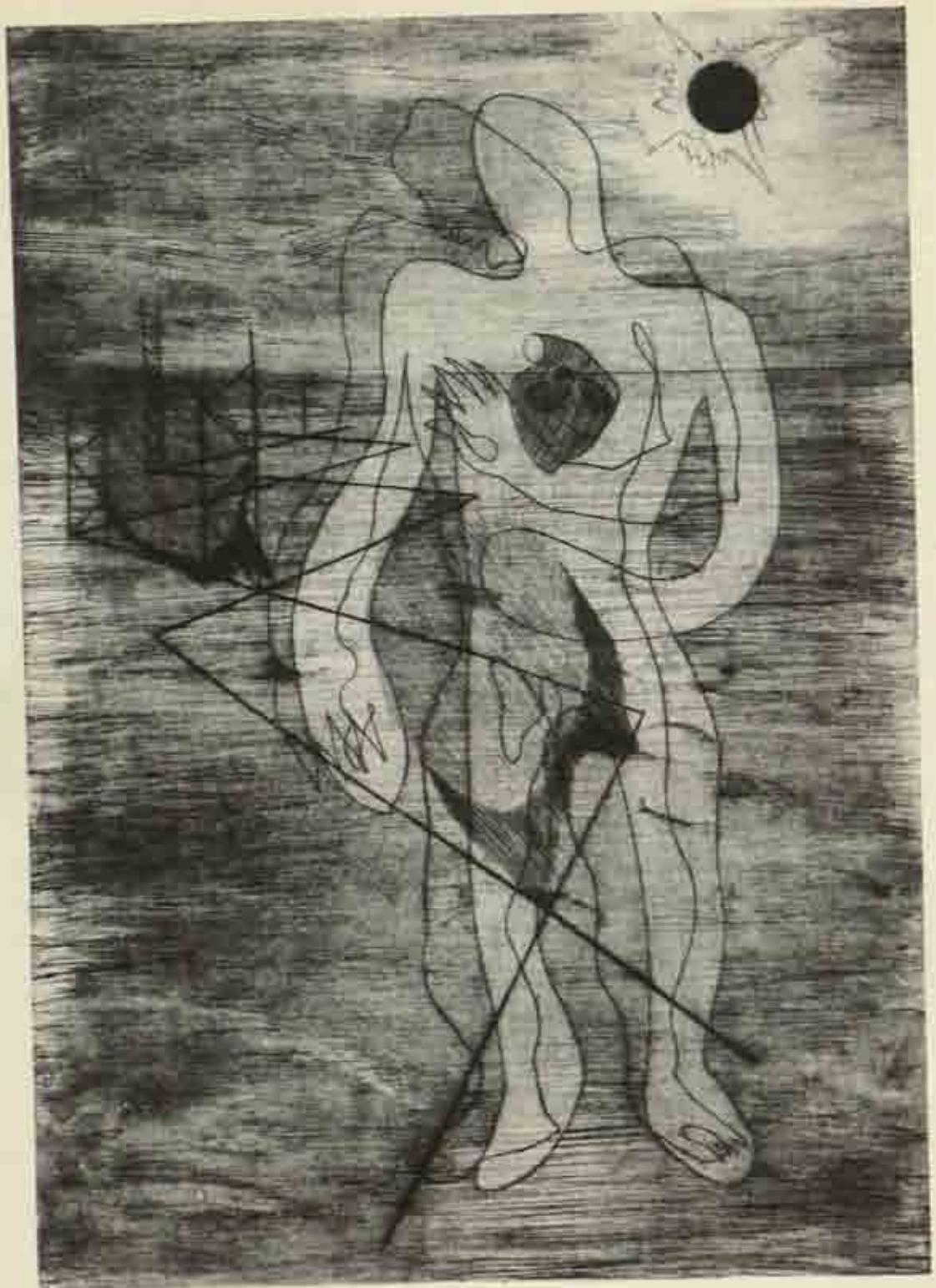
Fig. 15. S. W. Hayter: Apocalypse III, 1931

away, regaining half tones, various in-between values, and whites. The scraper gives a clear, harsh accent which does not print white unless burnished, while the burnisher alone softens and lightens in a less precise fashion. The final effect can have any degree of photographic detail, and may resemble a charcoal drawing in color, but it has that certain velvety softness characteristic of the dry point process.

Employed with engraved lines or with previously etched lines, the method has been used by a few modern artists; but, on the whole, those effects which are characteristic of mezzotint are not those which are sought by artists at the moment. Like dry point, mezzotint wears badly in printing and requires to be steel- or chromium-faced before an edition of any size can be printed.

For repairing or replacing tones which have accidentally been lost in working, the roulette (Fig. 13) is used. Together with burin lines, rolling, the burr being removed afterwards, was used in making the illustrations for Georges Hugnet's *Ombres Portées*, Paris, 1932.

The method of working the background of the *Apocalypse III* (Fig. 15) could be described as mezzotint, although it was done in a single direction with coarse carborundum over the burin line. The transparency of the work of the burnisher on the figure is characteristic of this method.

The general principle of working back from a black or dark print surface to the lights is not, of course, confined to mezzotint, although it is the characteristic of the method. Plates which have been roughened to print black by aquatint, soft-ground textures, or closely bitten lines (see Jacques Villon, Fig. 11) can be worked in the same manner.

CHAPTER

3

BURIN ENGRAVING

Of all the methods which can be used to produce incisions in the surface of a plate into which ink can be rubbed and then printed under pressure, perhaps the simplest is the direct cutting of grooves with a burin or graver. It must not be forgotten, however, that no method by which metal is removed in order that a thread of ink shall appear on paper can be considered as direct and, although the principles are simple, mastery of the method demands the most serious practice.

THE TOOL

The burin (Fig. 4E) is a short steel rod, square or lozenge-shaped in section on edge, the end of which has been cut off to form a facet at an angle of 45° to the axis of the stem; the rod is suitably mounted in a handle. The tool is bent near this handle, to make it easier to lift the point clear of the cut, and the two underfaces are ground perfectly flat and parallel. Process engravers use a tool of which two small facets have been ground off at the point. This tool, the same in profile as the artist's burin, produces a broader and more uniform cut, the tool being

held at a greater angle of attack than the one which has been ground parallel to the axis.

The advantage of the tool, correctly ground for the purpose, is that inflections of the line can be produced with very slight variations of the pitch, making possible a very great sensitivity. The burin which
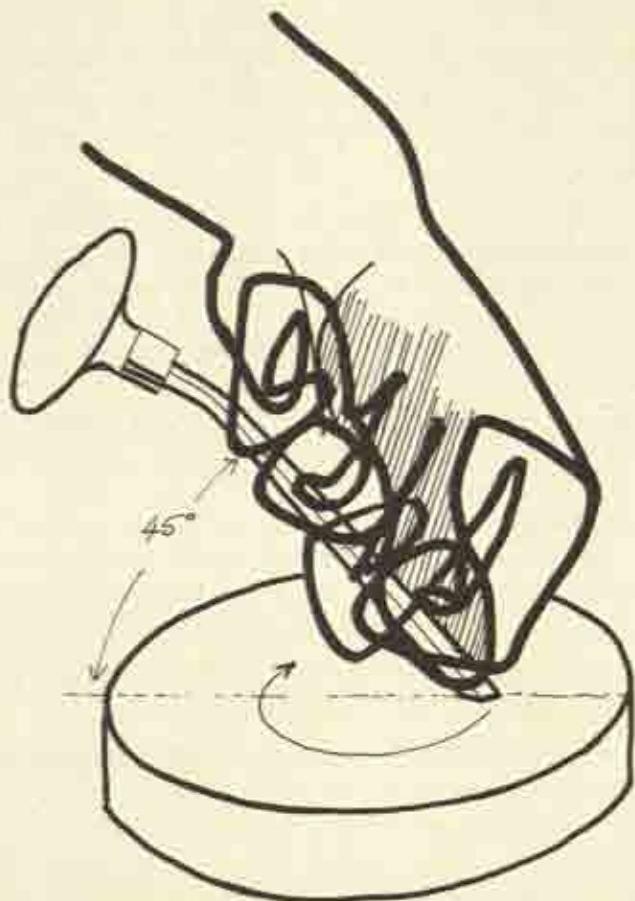
Fig. 16. Sharpening the Burin

is square in section is the most generally useful as it raises almost no burr on straight lines and turns with great freedom. The deep lozenge-section burin, the accurate setting of which is harder, turns with greater resistance and throws up far more burr, and is really only necessary when greater depth is desired in extremely fine lines, lines as fine as a hair or even less. With this tool it is quite practicable to employ lines 1/3 of the width of a hair, laying them 1000 to the inch.

Sharpening the tool

When a burin is made, the underfaces must be set perfectly straight and parallel to the length of the tool, and the edge between them must be absolutely sharp. This is achieved by applying great pressure to the blade laid flat on a level stone, with the fingers of one hand, while driving the tool diagonally with the other; it must be held in such a position that the blade cannot roll or turn. When perfect, no reflection of light is visible from the edge between the two faces. It is preferable to rub away some of the outer surface as the steel at the core of the tool retains its sharpness longer.

Light straw color is the best temper for a tool. The end facet is then ground to an angle of 45° with the length, the tool being held by the shaft, as near the point as possible, and rotated on the level surface of the stone (Fig. 16). (If the wrist is rigid while this is being done a flat surface will be produced; if, however, there is movement of the wrist a spherical surface will result).

The angle of 45° has been found by experience to be the most generally useful for all purposes. The longer point, set at an angle of 30°, which is used in wood engraving, breaks too easily and will not turn freely without raising a burr on the line. The shorter point, at an angle of 60°, is useful for stippling or for dotting, where it breaks less frequently, but in lines of any length it shows a tendency to rise out of the furrow with a consequent loss of control.

Unless a burin is extremely sharp, it will not make very fine lines (that microscopic tetrahedron of metal which it should cut will be missing entirely), and the characteristic responsiveness and flexibility of the tool cannot be appreciated. The keenness of the point should be such that, when rested upon a plate, the mere weight of the burin will make an impression.

THE PLATE

For burin engraving copper is always used, in plates of 18 or 16 gauge, preferably with the surface slightly dulled. Thinner plates are awkward to handle and can cut the fingers while being manipulated in the process of printing, while thicker plates offer no advantage and can strain or burst the paper under the pressure of printing.

If the copper has been prepared by hammering, or if it has been left undisturbed for many years, the crystallization of the metal is established equally in all directions, thus hardening the plate. This is a defi-

54

nite advantage in cutting. Such plates cost three times the price of rolled copper and can be obtained from John Sellers & Sons, 66 West Broadway, New York 12, N. Y. and The Cronite Co., Inc., 35 Park Place, New York 7, N. Y. Commercial rolled copper is decidedly softer in one direction than the other, the metal crystallizing in the direction in which it is rolled. More burr will be raised on lines cut in the softer direction, and the diminished resistance in that direction results in a tendency for the burin, on a curved line, to run away, the hand being controlled to cut the harder metal losing that restraint on unexpectedly encountering the softer. Rolled plates may be bought from C. G. Hussey & Co., 140 Avenue of the Americas, New York 14, N. Y., and Harold Pitman Co., 1110 13th Street, North Bergen, N. J. Sources for rolled plates in Great Britain have been mentioned on page 35. Owing to local conditions hammered plates seem to be unobtainable at present.

Zinc plates should never be used for burin engraving, as the metal is soft and crumbles when pressure is used against the tool. Brass and soft steel are no longer worth using, as they lack the flexibility of copper, and the endurability desirable for the printing of enormous editions can be obtained by placing a steel or chromium facing on a copper plate.

It will be found more convenient to work on a slightly dulled plate, as this avoids the glare responsible for so much eyestrain among engravers, and allows one to draw with a soft pencil on the surface. If the plate is highly polished, scrubbing with a rotary movement using water and fine pumice powder (ordinary kitchen scouring powder will serve if not too gritty) will produce the needed effect. As in all printing processes, the work on the plate will be reproduced in reverse upon the print. If this has not already been planned, a drawing on thin, strong paper may be traced over carbon paper, face upward, and the reversed drawing will emerge on the back of the sheet. Then, to transfer the drawing to the plate surface, this may be pinned face down over the plate, backed by a sheet of white transfer paper. The lines are then followed with a hard pencil or burnisher.

THE CUTTING

The burin, prepared as described, should be held between the middle finger and thumb, the handle lodged in the palm of the hand, the fore-

finger resting *lightly* over the point (or beside it on the plate), and the other fingers should be curled up to avoid interfering with the vertical movement of the tool.

In cutting, the axis of the tool should remain vertical. Sit facing the table diagonally, with the right elbow resting upon it, the plate on the edge of the table, under the eye. Fingers do not need to be contracted, the pressure coming entirely from the palm of the hand or from the thrust of the plate moved by the other hand, so that there is no need to grip the tool with any degree of force (Fig. 17, and Frontispiece). Working with the hand relaxed, the result generally is more sensitive and expressive.

It is most important that *no* pressure be exercised by the forefinger. Forcing the tool down into the furrow increases friction, and the consequent increase in the force needed to cut destroys the sensitivity of the line; it is, in fact, like driving a car with the brake on.

In engraving it is completely unnecessary to strain the eyes. The process engravers' habit of working with a watchmaker's glass in the eye is pointless in the case of original engraving. In the design, the line cannot be seen as it is being covered up by the hand, owing to the angle at which the tool is held, so there is no reason to strain the eyes by attempting to follow it. It is preferable to work with unconcentrated eyes, the direction and depth of the line being controlled by the touch alone, a far more sensitive and accurate control than that by vision. A difference of about 1/100,000 inch can be distinctly felt, although such an interval would be quite invisible to the eye.

To begin, the point is engaged in the copper surface with a gentle pressure applied to the handle, the angle of attack being decreased until the burin moves freely. An increase of the angle while moving will cause a broadening and deepening of the line. Always cut slowly: in the case of heavy incisions, extremely slowly, so that although a shred of copper 1/32 inch wide is being removed, comparatively little force is applied. Any other procedure will result in the loss of the sensitivity and flexibility of the line.

Unless the burin is perfectly sharp it will be impossible to cut out boldly against the resistance of the metal without hindrance.

Curves are produced by rotating the plate, the burin hand moving very slightly. It is immediately noticeable that where a certain pitch, say 5°, is needed to produce a line of a given force, a greater angle of attack, say 7°, will be needed to give the same strength on a curve, and

56

Fig. 17. Hands and Burin on Plate

perhaps double the angle or more for a very close curve. Unless this is done the burin seems to run away. At first the beginner will not realize how much he has to rotate the plate to make a curve; he will tend to flatten and stiffen his forms. Since much of the burin work seen has been executed by people who have never developed their skill beyond this point, burin work is often assumed to be characteristically stiff and awkward. Exaggeration of the lightness and depth of lines and the boldness of curvature is advisable for the beginner, to avoid the sameness which is the mark of an inexperienced burinist.

At this point, particularly if the furrows have been cut freely without following a trace made previously on the copper, the peculiar characteristics of the line of the burin should be considered by the beginner. In almost every method of making an image except sculpture in the round, the execution of the work is carried out by the hand moving independently (or, in certain cases, the fingers alone), the work being surveyed from a certain distance, as though dissociated from the artist, and the characteristic muscular action is that of pulling, or, as one says, *drawing*. Now the line which has just been engraved was not *drawn*, it was driven: the sensation of the engraver in making it is one of traveling bodily with the point forward in the direction of the design. Then, owing to the rotation of the plate, another quality is felt. The artist, identified with the moving point, must orient himself in relation to the changing positions of his design, just as a traveler orients himself with relation to a position shown on a map. A further peculiarity of the burin cut is the sensation of the engraver, not of tracing upon a surface, but of cutting into the substance of the copper, breaking through the surface, to which he *almost*, but never quite, returns in the finest of his lines. This sensation is not illusory, for, as the line, when printed, is definitely above the surface of the paper, the depth of penetration into the metal actually involves a corresponding displacement of the line in relief above the sheet (Fig. 18). Thus a wider and deeper cut, crossing a shallower and narrower cut, will print with the former raised above the latter. A photograph of an uninked plaster cast of an engraved plate demonstrates this clearly (Fig. 19).

It might appear that this provides a method of constructing a positive, three-dimensional space without ambiguity, but the reality is less simple. A little experimentation will show that while a definite *separation* always remains, it is about as easy to see this effect in re-

58
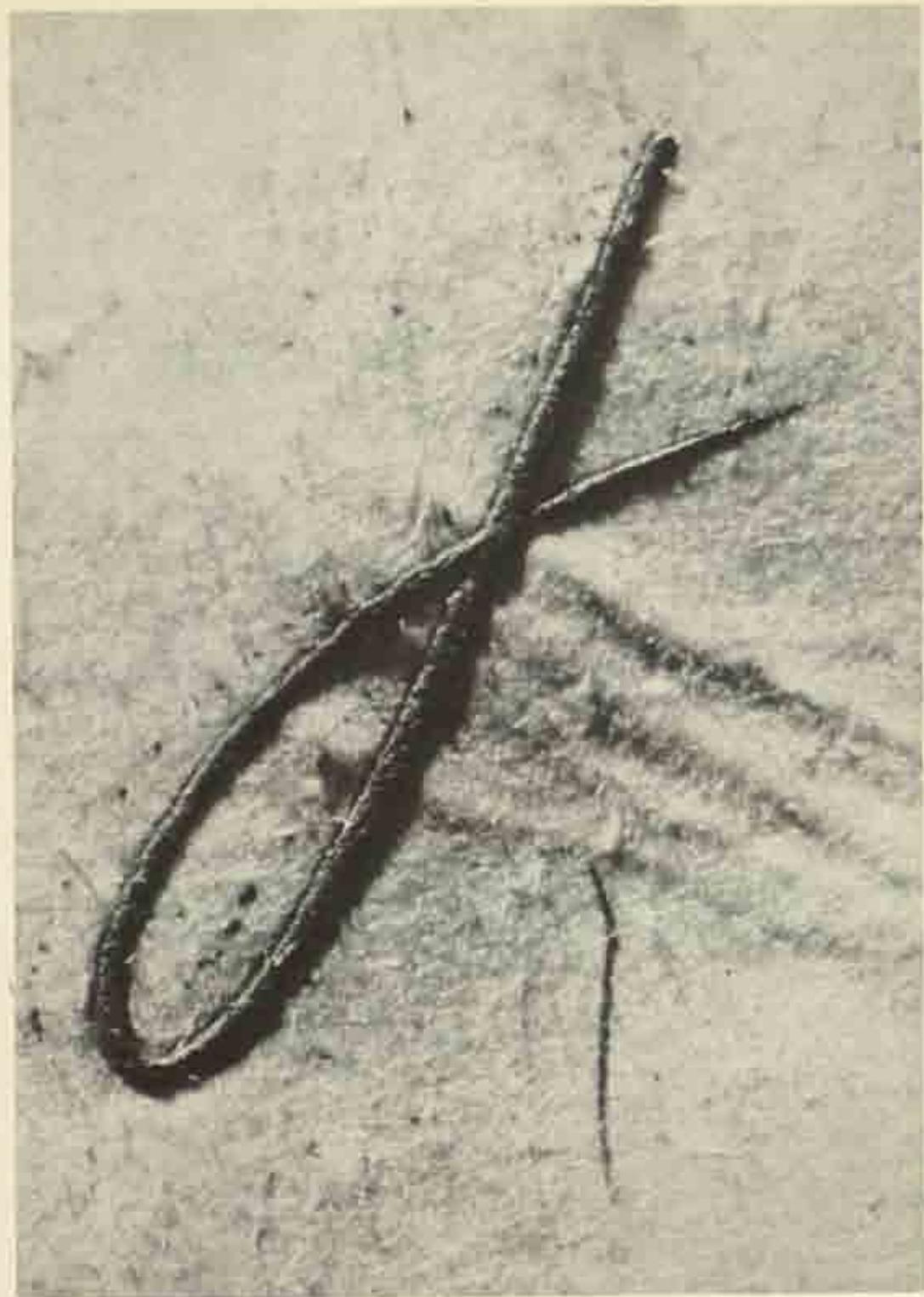
Fig. 18. Enlargement of the Print of a Burin Line

Fig. 19. Photograph of the Uninked Plaster Cast from the Plate for "The Runner" (1939) by S. W. Hayter

verse as it is to see it directly. That is, the finer line can be seen as well in front of the heavier line as behind it (where, of course, it is). So our means of expression still retains the alternation, the ambiguity which is found in most of the "intaglio" processes. There exist, however, methods of *cancelling* this separation in space: a round dot, for instance, marking the intersection of two lines of unequal depth seems, visually, to knot them together in the same plane (Fig. 105).

The line to be cut may be entered strongly, the burin attacking the plate at a high angle, and then being lowered until movement commences; or it may be entered with a very fine trace, with the burin almost horizontal, so that it is hard to define where the cut starts. When crossing another line a slight nick from the spine of the burin is made. (See Fig. 19, upper left-hand corner.) If necessary this can be removed with the burnisher.

Lines may be ended in three different ways:

(*a*) by withdrawing the tool from the cut, and removing the thread of metal from the end with the scraper; this results in a square-ended line;

(*b*) by lifting the tool vigorously from the furrow, leaving a short pointed end;

(*c*) by depressing the handle slowly so that the line becomes progressively finer until it ends imperceptibly; in this case, as the resistance of the copper is diminishing progressively, it becomes necessary to hold back the burin hand cautiously to avoid slipping.

When looking at a print it is always possible to see in which direction a line has been cut. In engraving, even more than in etching, the treatment and direction of a line have great importance in relation to expression. This must be decided (deliberately, or when the tool is familiar, almost automatically) with a view to the purpose of the work. The most elementary cut proceeds from fine to deep, the next one is uniform in force, and the third moves from fine to deep to fine again. They produce, respectively, a simple straight line, simple curves of uniform or regularly increasing curvature, and then more complex curves. Thus, if it is wished to isolate an object in white in an apparently dark hollow form, the procedure adopted to give this effect resembles the action of a sculptor in cutting away background to a line in carving, although, considered physically, the relief of the surface is in reality the reverse of what is perceived.

It is obvious that as soon as any number of cuts are made in a plate, they will assume a relationship which will modify their separate effects. In a form in which 50 per cent of the surface has been cut into, the reversal referred to above will always occur, that is, the impression will no longer be of a series of black lines on white, for the blacks will predominate. Moreover the balance between them will seem more important than that between the actual cuts, and they will appear to be in front of the black. Even when much less than 50 per cent of the total area has been engraved, if the black lines are connected and tend to surround or isolate a white form, that form will solidify at the expense of the surrounding black. This is an example of the *Gestalt* alternation of object ⇌ background.

It is possible, of course, to make very short cuts which will function like dots. A clean triangular dot is made by driving the burin into the plate at an obtuse angle and removing the shred with the scraper. The *flick* dot, a two-pointed lenticular form, is made by engaging the point and jerking upward and forward. A round dot is formed by rotating the plate, a larger dot by rotating the plate against the burin leaning to one side: almost the only occasion upon which the axis of the burin is not kept vertical to the plate. It is also the only time when it might be desirable to use a burin with an end facet blunter than 45°; since dotting subjects the point to extreme stress, some engravers keep a tool sharpened at 60° for this purpose alone.

The infinite combinations of dots and lines, of differing length and thickness, permit the elaboration of texture in the print. Equivalents of color can be obtained by these textures, as by the use of etched lines and transferred textures in etching. Where it is wished to end a series of cuts in a previously made line, a slight raising of the heel of the burin at the last moment before reaching the line will cause the point to click into the furrow, without any risk of traveling beyond it. Where it is wished to traverse a line already made, a very slight depression of the heel will permit the cut to pass without deflection. One method of making a closely linked line of arrow-head dots consists of dotting firmly in the furrow of a line already cut, then burnishing the spur-shaped burrs forward in the direction in which the dots were made so that they will, to some extent, seal up the furrow. This is valuable as a method of destroying a too persistent line. It enables the engraver, also, to fill the end of a line that has been carried too far; though, of

62

Fig. 20. Pablo Picasso: Le Combat, 1937. Burin and Dry Point

course, 1/16 inch is about the maximum possible by this means.

As soon as the main design is established or a small portion of the plate has been worked out (whichever method is adopted), a print should be made. Just as many of these working prints, "states," as they are called, should be made as are needed to follow the progress of the work. There is no fear of wearing out the plate as a well-cut burin engraving will print 500 impressions without steel facing.

At this stage serious errors may be found in the plate. It is very simple to correct them, and every engraver should know how to do this. Otherwise he will be at the mercy of every accident that may occur.

Joseph Hecht (Fig. 21), in my opinion one of the greatest living burinists, had the gentle habit of inviting beginners at the first lesson to take a burin and make as deep a cut as possible in the plate. In their enthusiasm they would often break a point. He would then require them to remove the gash so that he could not detect where the correction had been made; they often spent a week in obliterating that first jab. This may well have been planned to test the fortitude of the aspirant, but, actually, corrections should not take so long.

Very fine lines may sometimes be removed by burnishing in the direction of the line until the copper has closed over the place entirely. The procedure, in the case of deeper lines, consists of marking with calipers on the back of the plate, very accurately, the position of the section to be removed. Then the plate is hollowed out with the scraper until the lines disappear, and the back is hammered up until the face is level. This is done more rapidly by gumming one or two thicknesses of paper to the back and passing the plate, covered with paper, once or twice through the press, which will apply enough pressure to push up the metal. The job is then finished with Scotch stone and water until the marks of the scraper are removed; then, charcoal with water is worked across the direction that was employed for the stone. When the plate is complete, the slight gray of the charcoal may be removed with jeweler's rouge, very fine emery paper, or any other polishing agent. Each operation *must* be perfectly completed before starting upon the next.

In the execution of a project it may be necessary to establish some trace of it on the plate before starting work with the burin. Although a tracing with white transfer paper may be used, the practice of drawing (pulling) lines on the plate, and then copying them with the driven

tool is most undesirable, if the artist is to arrive at any conception of the function of the burin in originating a work of art. However, if a large or complex project is to be undertaken, which requires the swinging of the plate in every position in relation to the engraver, it is neces-

Fig. 22. Ian Hugo: Jungle, 1944. Engraving

sary to have the relationships and the directions mapped out. Otherwise the design may be carried clear off the plate.

Atelier 17 has generally used the white-coated paper, applied over the plate, with the main elements drawn through it. The white traced line which remains on the plate is useful for situating the design but it most certainly should never be *followed*. It is fortunate, in avoiding this, that the breadth of the trace, sometimes ten times that of the burin lines to be cut, permits free construction of the design with the tool itself. It is possible to draw with pencil on a slightly dulled copper plate, but again it is most essential that the work should originate with the tool and not be transposed from a pencil trace.

The first artists we know who made use of the burin were goldsmiths who worked primarily for the appearance of the metal, rather than for any consequent print. Although we work now with an eye to the print rather than to the metal, if the plate develops beauty itself, the print also will probably be satisfying. It does not necessarily follow, however, that a plate which is not in itself handsome will fail to give an interesting print, but this is exceptional. Ian Hugo's print, *Jungle*, (Fig. 22) is an example of a plate worked first of all for the copper and for a print only secondarily.

CHAPTER

4

ETCHING 1: BITTEN LINE - SOFT GROUND - LIFT GROUND

THE BITTEN LINE

Preparation of the ground

The first step in making an etched plate is to obtain a coating on the surface of the zinc or copper plate which will resist the action of acid. This coating should allow a point to penetrate without undue resistance (with the consequent pressure on the point), but at the same time it should not crack or flake off in closely worked passages, and it should, further, be able to stand up under the action of the acid for many hours, if necessary. It is also an advantage to have protective films that do not crystallize, harden unduly, or crack, when stored, as it is sometimes necessary to prepare plates and keep them for years before exposing them to acid.

In the various products used for this coating attempts have been made to combine all of these qualities. Actually, few possess them all. The preparations come in two forms: liquid varnishes and solid lumps. The most generally used composition consists of 1 part resin, 2 parts bitumen and 2 parts beeswax. In certain colorless grounds a greater proportion of resin is used in place of the bitumen. The most commonly

used resin is colophony, but Damar resin can also be employed in preparing a ground.

The grounds used in the seventeenth century were much harder than those used today; they were often mixtures containing heavy linseed oil which were *burnt* on to the plate, giving them an almost enamel-like hardness. The tools used to work through these grounds were sharp cutting tools of the type of the echoppe (Fig. 4D), and the whole process of etching was looked upon as an easier and more rapid method of obtaining the effect of burin work. These grounds, however, had the disadvantage that they were less resistant to strong acids than the modern, softer compositions. Grounds dissolved in nut oil were also applied in liquid form and the volatile oil was driven off by heating the plate. The surface of some of these grounds was sometimes covered with a coating of white lead, applied over the acid-resistant film, so that the mark on the plate would appear in black on white, rather than as the bright metal against the black of the bitumen.

If a ground contains too large a proportion of bitumen the resistant coating cracks easily; if there is too much wax, it softens under the hand while working and its resistance to acid is decreased. When, as in very rapid biting, the plate becomes warm, the edges may bubble or allow the acid to bite under the coating. With liquid grounds if the drying is extremely rapid there is a tendency to crack; should the drying be slower they are often sticky, and have more time to pick up dust particles which weaken their resistance to the acid.

Preparation of the plate

The plate, preferably slightly dulled, should be cleaned with a paste of ammonia and whiting, or with acetic acid or alcohol to take away any traces of grease, and then the cleaning substance should be removed with running water.

The water will spread over the whole surface of the plate with an unbroken film which will only break if grease spots have been left there. Unless the surface of the plate is perfectly clean the coating will not adhere and, when it is placed in the acid, it will lift off it, exposing the dirty places.

The plate is dried by heating it, without touching the surface with the fingers, since traces of grease persist on the hands even after washing.

A small quantity of the ground is melted on to the heated plate. For this the upper surface of the block of wax is used as any foreign matter which has found its way into the block during its preparation will have sunk to the bottom. It is usual to keep the ball of ground wrapped in fine silk so that any particles of grit which fall on it will be caught in the material. The outer surface of the ground must also be kept free from grit or any other impurities.
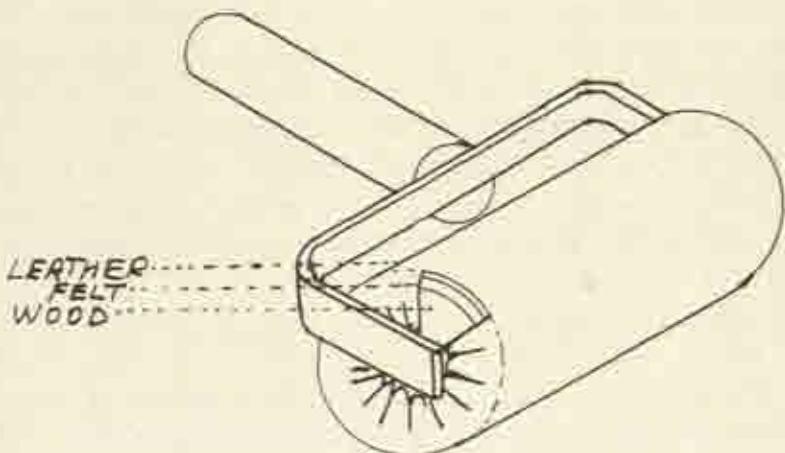
Fig. 23. Grounding Roller

Next the leather roller (Fig. 23), free from dust, grit or fibers, is passed over the plate, becoming coated with the wax and distributing it over the surface. At this point the plate is too hot to finish; in a ground applied at this temperature it is inevitable that bubbles of air should be left under the surface. At this juncture the plate surface appears shiny. By moving the plate to the cooler end of the hotplate, it is brought to a temperature which is just bearable to the fingertips, applied lightly below the edge of the plate. The plate rolled at this temperature is covered with an even *mat* surface of a definite brown color, free from holes or bubbles.

If the plate cools too much during this operation the wax comes off the roller in blobs. Re-heating will be necessary to take these up again on the roller. Should too much heat be applied the ground will start to burn, a condition which is made obvious by the presence of smoke.

70

The hand vise is then clamped on one corner or in the middle of one side of the plate, as is convenient, and the plate, still hot, is passed, with the grounded side down, over the flame of a taper (Fig. 24), care being taken to avoid touching the surface with the wick or keeping the flame too long in one place where it may burn the ground. The soot will melt entirely into the ground, leaving a brilliant black surface which becomes dull black on cooling.
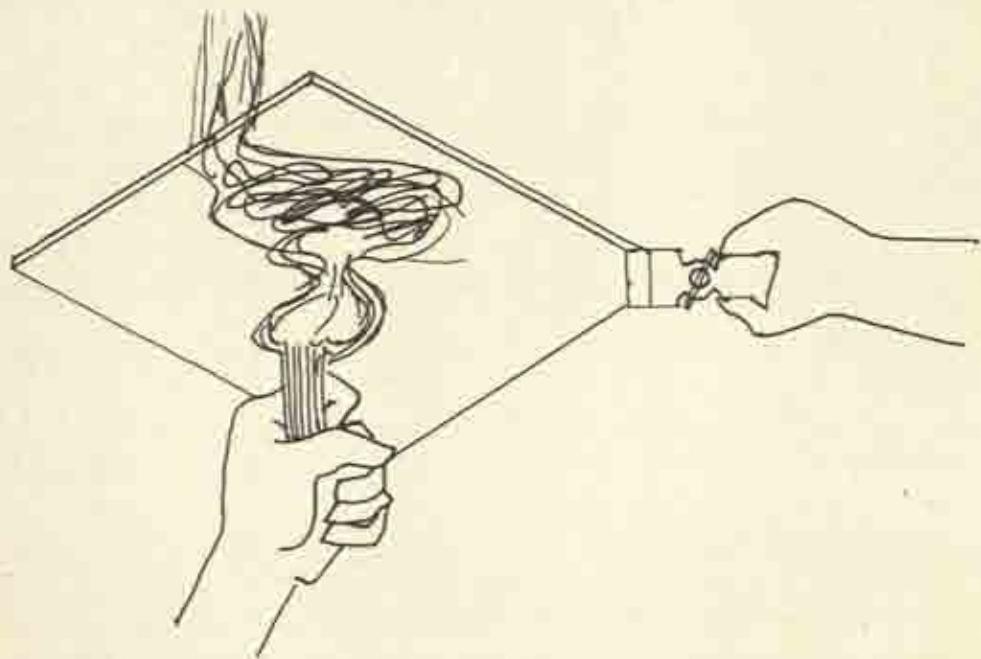
Fig. 24. Smoking Hard Ground

During the whole process care should be taken to prevent dust, fluff from the sleeves, hair and so on falling on the plate as the weak points created by such particles in the surface of the wax will allow the acid to penetrate. It is well worth-while for the beginner to spend a few hours in thoroughly learning this process as it can be carried out very rapidly once the right temperature has been found, and it has been realized that the first essential for a clean plate is a good ground. The dabber, described on page 32, may be used instead of a roller, but it takes longer to prepare a plate of any size and the coating deposited is more irregular in thickness, as well as being generally thicker, and is more liable to crack.

There are many liquid grounds similarly constituted. The materials, the same as those in the solid grounds, are dissolved in ether, chloroform or petroleum-ether. The simplest method of laying these liquid grounds is to pour a quantity of the filtered liquid over the plate, letting it drain while pouring the excess back into the bottle through a funnel. Dust on the surface of the plate or in the liquid must be avoided. I have never found it as satisfactory for all purposes as the ground laid with the roller, though a plastic base varnish, as used by process block makers, is very resistant. This, however, also offers great resistance to the point in working.

A pencil drawing of the subject on hard-surfaced paper (tracing paper) may be soaked with water, laid face down on the grounded plate, and transferred with the press. For this *less* pressure is required than is used in printing, one blanket being removed. The process does not damage the ground if it is done carefully. The drawing appears in reverse as a gray line on the black surface, and it can be followed with the point.

Needling

The needle, either a steel point in a wood or cork handle or, more commonly, a phonograph needle in a holder or pin vise, is held like a pencil, but rather more perpendicular to the plate. In working with the needle the weight of the hand provides sufficient pressure; too much pressure, or too sharp a point, produces a shaky and uncertain line. Should one have the habit of drawing freely from the elbow or the shoulder rather than with the fingers only, in the cramped position of the rested hand, the line will be correspondingly clearer and firmer. As in all etching processes the quality of the line will be seen as if magnified, this quality has more importance than it would have in drawing. A method I have found useful is to trail the second finger on the surface of the plate (Fig. 25) as this serves to steady the hand in making long sweeping lines. It is, of course, important to avoid scratching the ground with the fingernail. Many etchers keep a paper under the hand to avoid this, as well as to prevent the softening of the wax by the warmth of the hand.

It is desirable to open up the surface of the plate clearly; any method of laying bare the parts of the plate to be bitten will serve. A cactus spine phonograph needle runs very freely and does not cut into the metal; a star wheel such as the tool used for tracing embroidery de-

72

signs will give a dotted line and a comb or a number of needles held in a clamp can be used to give a series of parallel lines. When the plate is examined after needling is completed, the lines should show
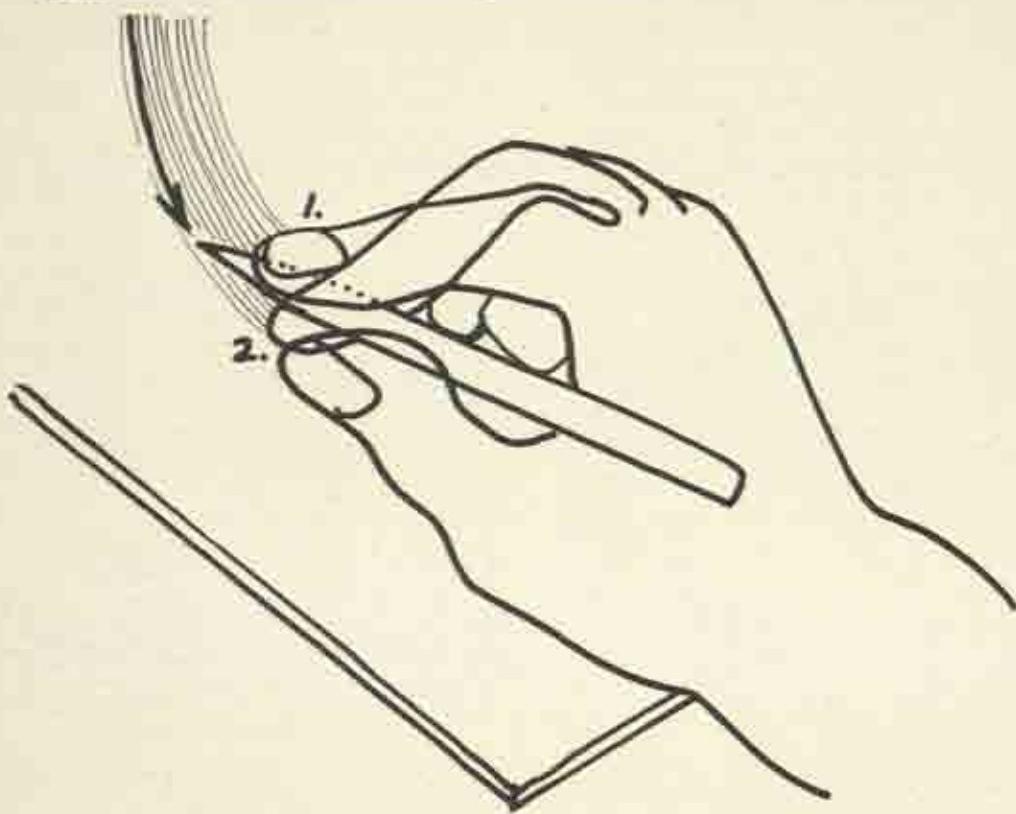
Fig. 25. Point and Position of Second Finger

clean metal. If they are yellowish or brown, there is probably a trace of the ground still in the groove and such lines will not start to bite as soon as the clear ones. Often they will open as a series of dots, generally broader than the finest line. Such faulty work will not be conspicuous in strongly bitten passages, but will be undesirable where fine lines are wanted.

It is possible to carry out all the work on the plate with the same point, trusting to the acid to produce all the variations of strength desired, but to save time, particularly when producing the deepest blacks, two or more points of different thickness and, for very wide areas, the edge of the scraper blade, can be used. This can be seen on Picasso's *Danseuse au tambourin* (Fig. 26).

73

Fig. 26. Pablo Picasso: Danseuse au Tambourin, 1944. Aquatint.

Fig. 27. Anthony Gross, Study of Waves, 1935, Etching

Here it should be noted that a groove in the plate, in order to hold ink so that it will print black, must have a depth proportionate to its width. A broader line must be bitten deeper than a fine line. If the furrow is too shallow, ink will not be held in the center where a gray will appear between two black margins, as the walls alone will retain the ink. Such a gray space is known to French etchers as a *crevé*.

Biting and stopping-out

There are two methods of planning the biting of a plate. In one all the lines are opened up at once and different parts of the plate are exposed to the acid for different periods by progressively stopping out first the fine lines and then the heavier ones. In the other, only the strongest lines are marked first, exposed to acid, the next in strength added, rebitten, leaving the first open, and so on.

The beginner should remember that stopping-out is a process of sealing lines against the acid, and although he is using a brush he is not painting. Once lines have been bitten in a plate it may be necessary to pass over them three or four times; as the first coat sinks into the line, the second may fill it and the third may be needed to seal the edges at the surface. The use of a transparent resin solution in stopping-out has an advantage in that it leaves the finer work visible for comparison with the deeper bitings.

Where white or lighter effects are wanted in a closely worked passage, it is simpler to ignore them during the needling and stop them out. This permits work in white on black to be done directly. It is obvious that it will be easier to use the second method where fine lines pass across heavy lines, as it would be difficult to stop out the smaller lines without blocking the others. Similarly, where broad areas of different but uniform strength are to be bitten, the first method will be more convenient. In practice both are used according to the requirements of the passage being worked. Without stopping-out it is still possible to produce wide variations in the intensity of the biting in the acid bath. Gradations of strength over part of the plate can be made by tilting the bath, with little acid in it, so that one edge, one corner, or half of the plate is covered (Fig. 28). Then the plate can be moved at intervals, the acid agitated by blowing or by rocking the bath slightly, so that definite margins are not made. It is clear that gradations darker at the edges, lighter in the center, can easily be made by this method. However, if a dark center is required, with a light edge, the plate can be covered with water in a bath and concentrated nitric acid can be dropped on the center: as the acid diffuses in the water less and less action occurs and a dark center, grading to a light margin, is produced.
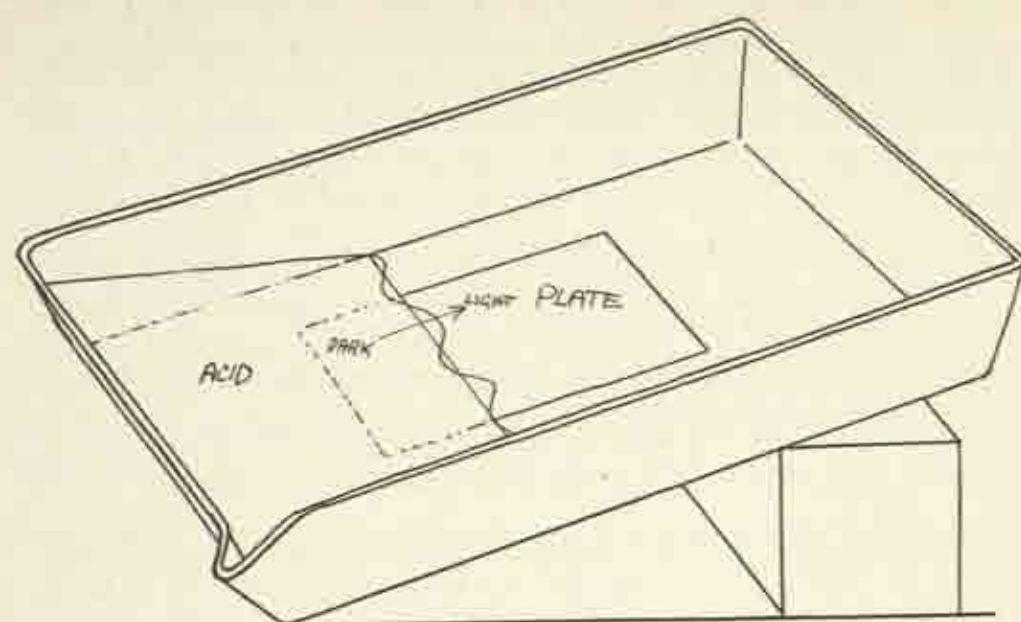
Fig. 28. Position of Acid Bath for a Biting Gradation

Before putting it into the acid the back of the plate, as well as all scratches, errors, or possible weak places are covered with stopping-out varnish.

Acid used for zinc

This consists of 1 part nitric acid to 12 parts water for a slow bath, and may be strengthened for heavy bitings. Hydrogen gas is liberated during the action of the acid on the zinc.

It is most important to avoid any trace of copper acid in the acid used for zinc, as zinc replaces copper in solution, producing a Zn-Cu couple with an electrolyte between. The electrical current generated will break down any ground so that it finally peels off the zinc plate.

Acids used for copper

1 part nitric acid to 2 parts water. Some copper should be in the solution or the acid will not bite regularly. Either some old acid can be added, or a copper penny dropped in for a few minutes until the acid is colored blue. This acid reacts with copper to produce bubbles of nitric oxide gas.

77

Dutch mordant: 2 parts potassium chlorate, 88 parts water and 10 parts hydrochloric acid. The salt is dissolved in hot water, then cold water is added to make up the volume, the acid being added last. A stronger mixture may be used if desired. Usually a saturated solution of potassium chlorate is employed: in use this slowly becomes less active, when more hydrochloric acid may be added. No gas is liberated.

Ferric perchloride: A saturated solution (45° in the Beaumé scale) diluted with the same amount of water. The perchloride also bites without liberating gas, but is less accurate than the chlorate bath. It deposits black copper oxide in the lines which has to be removed for the biting to continue uniformly.

Nitrous acid: May be used in the same proportions as nitric.

Acetic acid: May be used for very delicate bitings. It has very little effect on copper, and stronger bitings require one of the other acids. Its greatest value is for cleaning lines in a plate before biting, when these have been fouled with grease from the hand, for, despite its weakness, it is better for this purpose than the stronger acids.

Biting

The effect of these different acids on the plate is quite distinguishable in the results. Nitric and nitrous acids in biting give off nitric oxide gas with copper, and hydrogen gas with zinc; the bubbles of gas collect in the lines and produce a shallower and rougher-edged line than do either the chlorate or perchloride, which act through the presence of free chlorine in the solution and do not produce gas bubbles (Fig. 29). They cause some degree of undercutting of the edges of lines.

The gas bubbles formed by the nitric acid, if allowed to grow and left undisturbed on the surface, will prevent further action of the acid. Thus in a closely worked passage or on an unprotected plate they may produce a granulated texture, which has sometimes been deliberately sought (see Fig. 30).

This pattern of bubbles will be superimposed upon the pattern of the work. To make the biting as clear as possible, the bubbles are removed at intervals, by tilting the bath, which contains just enough acid to cover the plate, and exposing the plate to liberate the gas. This is preferable to the customary method of removing bubbles with a feather as foreign matter in the acid bath is undesirable.

Instead of placing the whole plate in a bath of acid the mordant can be applied directly with a brush and manipulated so as to give local variations in the force of the line. Owing to the practice of controlling the acid with saliva on the part of earlier etchers, the method is often known as spit biting. Another system, used when there is no bath large enough to contain the plate, consists in edging the plate itself with wax or plasticine, leaving a small lip at one corner to make pouring easier, and the acid is then poured directly on to the plate.

When a plate is taken out of a bath it *must* immediately go under the tap to wash away all traces of the acid from both sides. This procedure must become automatic with an etcher: the amount of damage that a single person with a plate dripping acid can do in a studio is surprising.
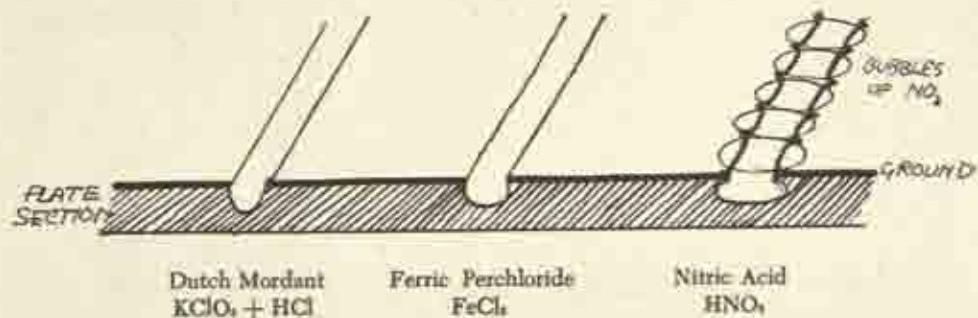
Fig. 29. Effect of Different Acids

Before stopping-out the plate must be dried, as a wet surface will not hold the varnish. This may be done with a clean blotter *firmly* applied, without shifting.

The length of time necessary to etch a line varies enormously with the temperature and the proportion of the plate surface exposed. Thus it is almost useless to attempt to control it by timing. A rise of temperature of 10° will almost double the speed of biting. However, it is useful to remember that if it takes one minute to produce a fine line, to double it in thickness and depth will require perhaps four more minutes and to double this again perhaps sixteen more. The extra minutes needed to increase regularly the strength of a line will follow geometrical progression, so that the intervals in strong biting should always be

79
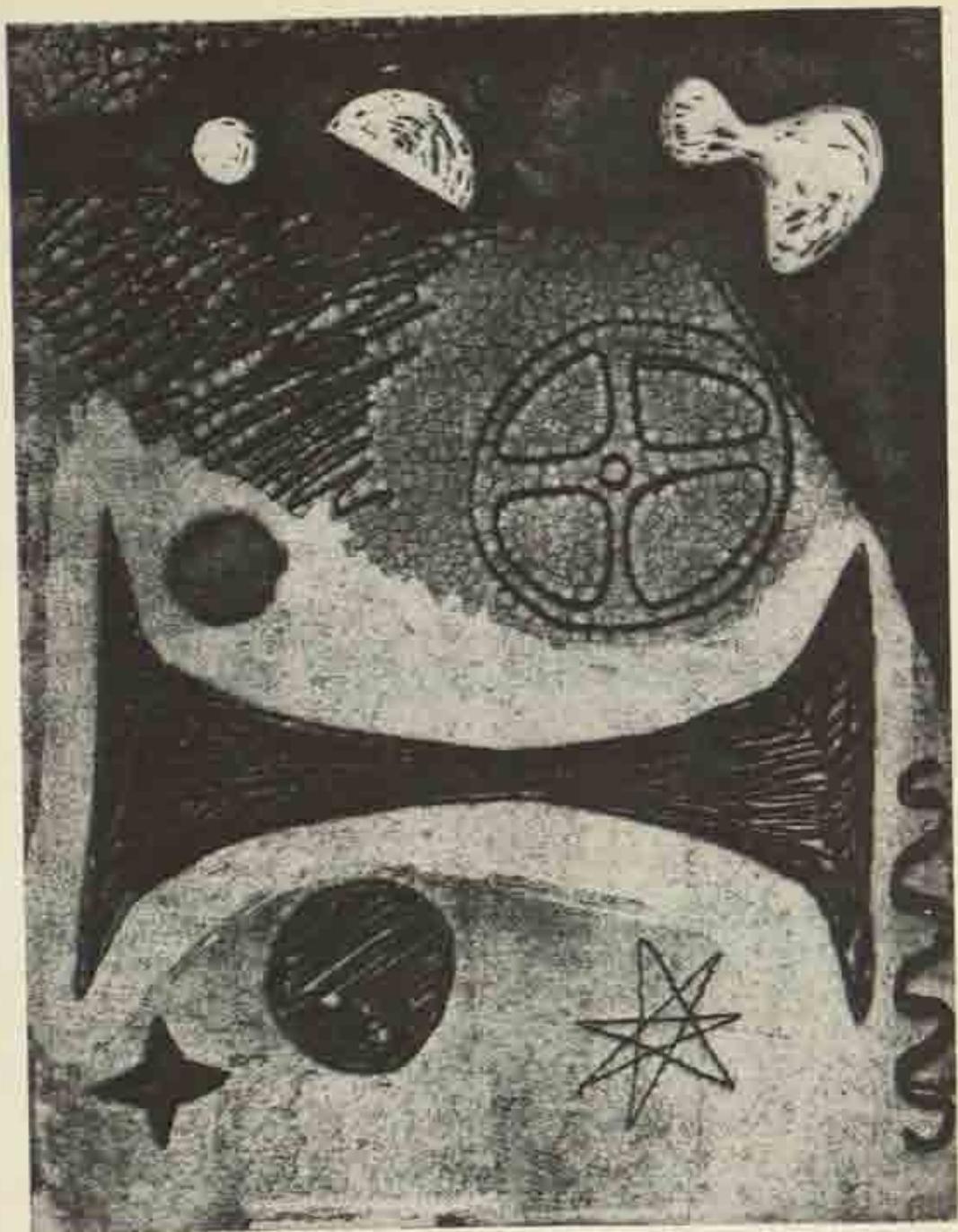
Fig. 30. Alexander Calder: The Big I, 1944. Soft-Ground Etching

exaggerated. The best method of control is by direct observation. If the plate is turned in the bath so that its surface reflects a source of light, the lines will appear as black against white, very much as they will print. Where nitric acid is being used, gas bubbles must be removed before observing, or an exaggerated impression of the force of the lines will be received.

When the biting is completed all grounds and varnishes must be completely removed from the back and front of the plate with benzene, gasoline, turpentine or another solvent. Then a trial proof is made (First State).

Rebiting

It is rare for a plate to be completed in a single ground. Certain parts may appear too strong, others too weak, or detail may be lacking. As the general planning of the plate dictates, overworked passages may be removed by scraping, burnishing, grinding with water of Ayr stone at this time, or after further bitings if it is preferred.

Where new lines are to be added or work rebitten, the plate is cleaned again with whiting and ammonia, and regrounded as before. All old lines are generally filled up with ground.

It is possible, however, to reground with the old lines left open for rebiting. This is done by placing a blank plate, of the same gauge, alongside the worked one on the hotplate, and when both have reached the correct temperature the blank plate is grounded first, and then the roller is passed to the worked plate, laying the ground without filling the lines. Another method of keeping bitten lines open consists in filling them with gouache white, or whiting mixed with milk, which dries in them; the surface is then polished perfectly clean and regrounded. The filling, dissolving in the water with the acid, lifts off, leaving the lines open.

Regardless of the technique employed for rebiting, the lines will never achieve the cleanness and precision of those made directly. Therefore, unless the undertaking would be too involved, it is better to open the lines again with the needle, held almost vertically.

Once the biting and rebiting of the lines has been completed in the plate, it is sometimes desirable to work it so that ink will be held not only in the lines but also on the surface between them. It should be clear that if the surface of the plate is exposed unprotected to the acid in

these passages, the edges of the lines will be broken down and the spaces between the lines pitted, giving the desired effect (see Fig. 31).

Etching-out

The foregoing description of how an etching is made gives the elementary method of making lines in a plate which is intended to be printed. Some of the errors and accidents noted have become the basis from which new methods of working have been derived. For example, exposure to acid under different circumstances may make a plate print darker, as described, or the acid may remove or lighten work already established. If the strongly worked parts of the plate are exposed unprotected to the acid for any length of time, the whole surface will gradually take on a granulated, gray texture, the tone depending upon the strength of the acid used, and the original lines will slowly become weaker and weaker until they *almost* disappear. The whole surface of that part of the plate will be lowered, and when it is printed, the print being a *cast* from the plate, it will obviously be above the unworked surface. However, when it is possible to regard the totality of all such elements as constituting a background or space, rather than a concrete object, it will invariably, in the print, appear to be below the original plate surface, an illusion that is strengthened by the fact that the margins will hold a black border of ink at the angles. In this way acid has been used to *remove* or blur the work already existing in the plate (Fig. 32).

This is attained by covering those parts of the plate that are to be preserved with asphaltum, drying it thoroughly, and then etching away the remaining surface with the *nitric* acid bath. As the surface of the plate is lowered the crystallization of the copper along the direction in which the metal was rolled will begin to show as a striation; the bubbling of the acid, particularly if a strong solution, will also impose a granulated surface. Any irregularities, lines or textures already in those parts of the plate will widen and soften so that, after a long biting (perhaps as much as nine hours), they will print like the weathered trace of a crack in a wall. When the print is examined the background, if bitten out, will appear to be below the surface of the untouched plate, as has already been explained. But by an inspection in a parallel light it will be revealed that the background is in front of the image, the reverse of what it seems. Thus, if a closed form is etched out in this

82
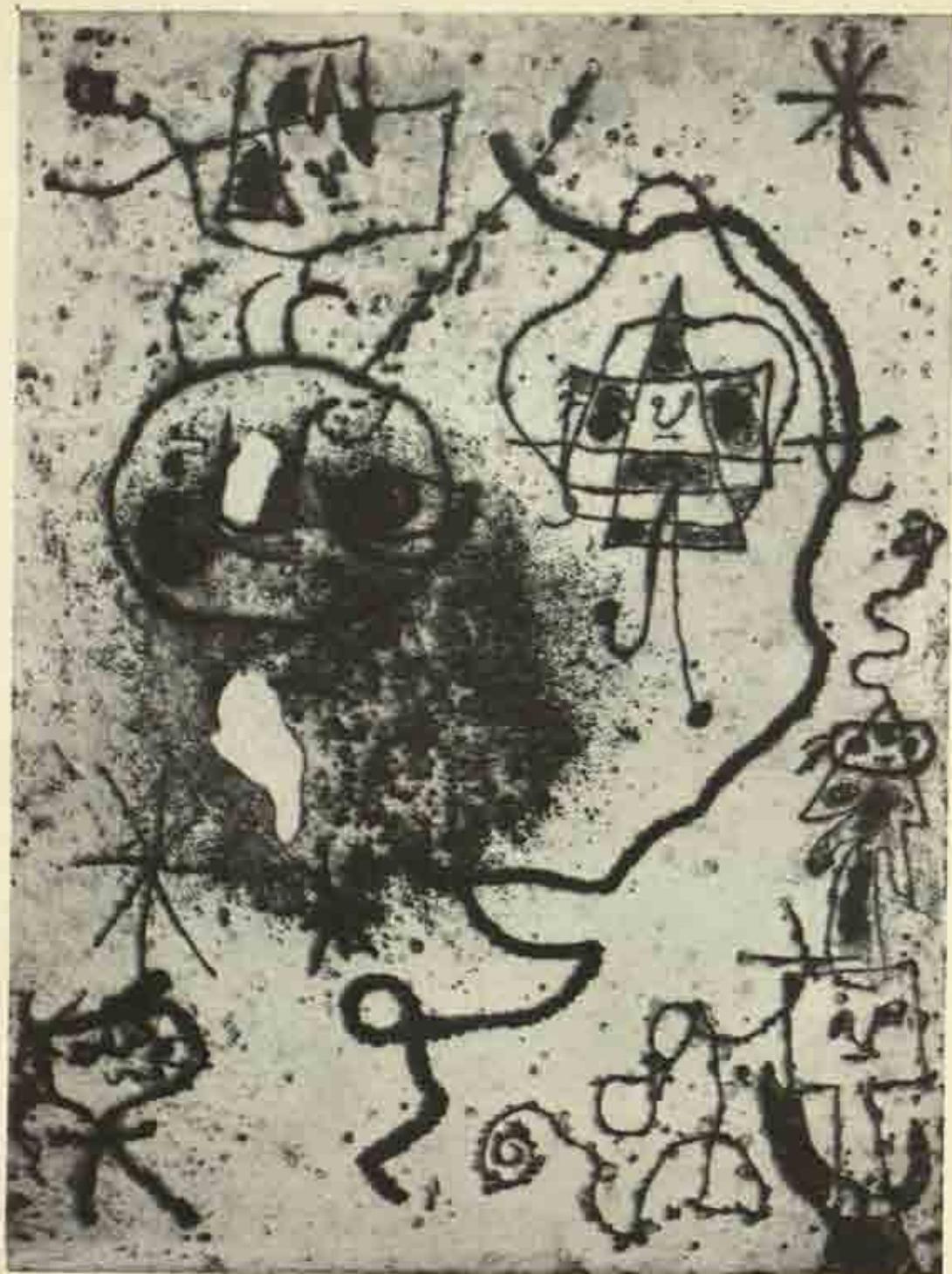
Fig. 31. Joan Miró: Fillette Sautant à la Corde, Femmes, Oiseaux, 1947.
Bitten Surface

Fig. 32. Enrique Zanartu: Composition, 1946. Bitten Surface and Textures

manner, that form will appear as it really is, a projection from the print surface. If, however, the form is an open one which can be regarded as a background, it will appear reversed. This alternation of

the object/background relation (*Gestalt*) and the reversal of apparent positions occurs frequently in etching and engraving, and the border-line cases give rise to an expressive ambiguity which I have found very valuable.

During the summer of 1947, the poet Ruthven Todd and I, with Joan Miró, experimented with the printing processes used by William Blake in the creation of his plates in relief (Figs. 33a, b). After many tries we worked out the method he probably used. A poem was written in a solution of asphaltum and resin in benzene upon a sheet of paper previously coated with a mixture of gum arabic and soap. (We had suspected that Blake used a transfer method, as his text, though very perfect in detail, is sometimes not perfectly aligned with the plate). A clean plate was well heated and the paper laid upon it and passed through the press. The back of the paper was then soaked with water and peeled off, leaving the resist on the copper. The designs were then drawn with a brush and asphaltum solution by the artist, the back of the plate was protected, and it was bitten in a solution of 1 part nitric acid to 2 parts water for at least 9 hours until the plate had lost about half its original thickness. Printing by a number of different methods followed (see Chapter 8).

Thus, it can be seen that a ground put on badly so that it is more or less porous, any matter on a plate surface that will cause the ground to lift, and the breaking down of the ground through the zinc-copper electrolytic effect are all means that have been employed for constructive purposes, under complete control.

SOFT-GROUND ETCHING

Among the resistant materials which can be used to protect a plate against the action of acid, the soft grounds have particular interest. An ordinary etching ground heated with grease, vaseline, tallow, or, better, the sticky grease used for axle lubrication, will produce a mixture which will protect the plate but which will never dry, so that any object which touches it will pull away the surface and expose the metal. A mixture of 2 parts ground and 1 part grease, or one of about equal parts or anything in between will serve as a soft ground.

Grounding

To prepare a plate by this means it is heated, as for grounding with the hard ground; the soft ground is melted on and rolled out with a
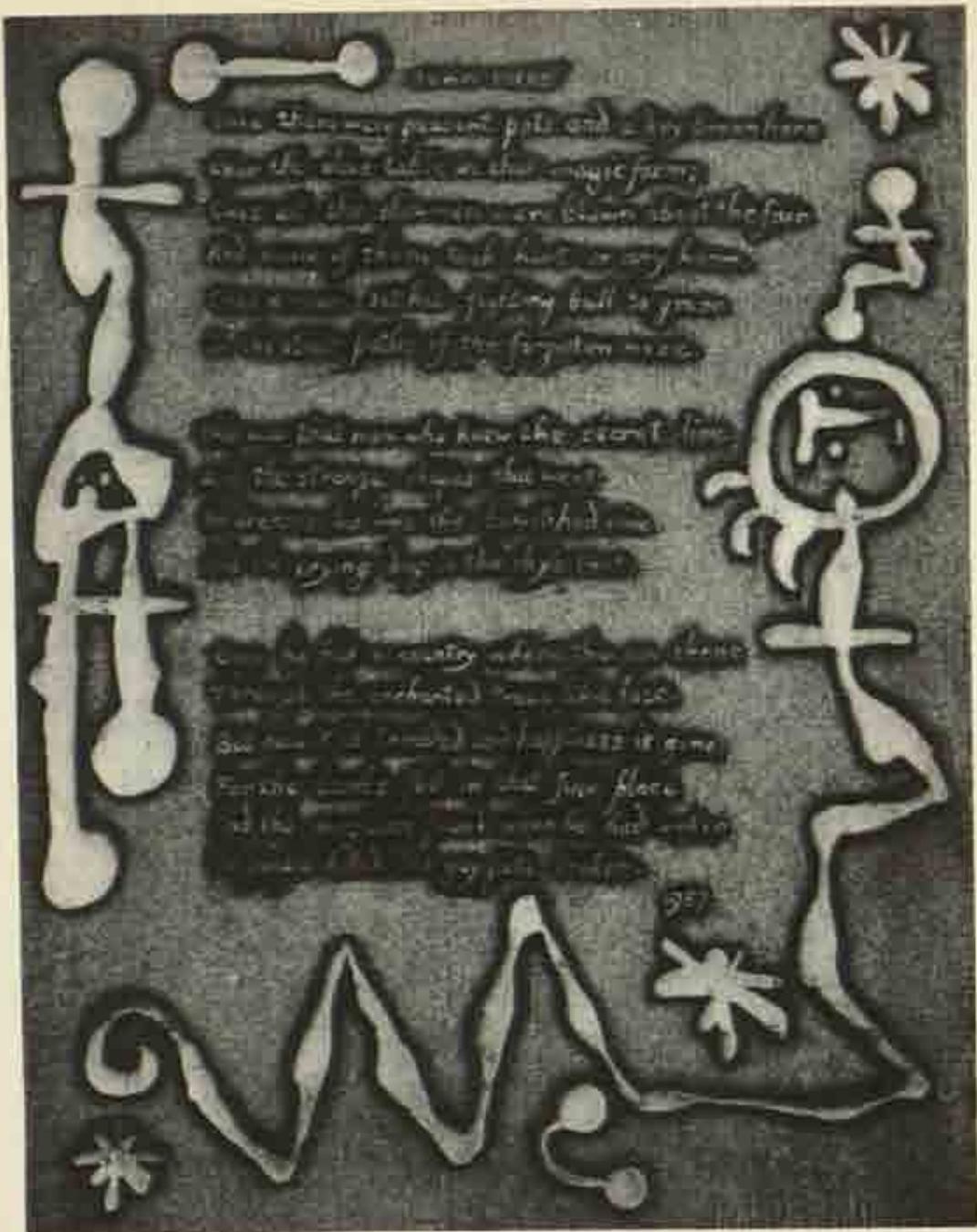
Fig. 33a. Juan Miró: Poem of Ruthven Todd with Decorations, 1947.
Intaglio Print

JOAN MIRÓ

Once there were peasant pots and a dry brown hare
Upon the olive table in that magic farm;
Once all the showmen were blown about the fair
And none of them took hurt or any harm.
Once a man set his fighting bull to graze
In the strict paths of the forgotten maze.

This was that man who knew the secret line
And the strange shapes that went
In dreams; his was the bewitched vine
And the crying dog in the sky's tent.

Once he had a country where the sun shone
Through the enchanted trees like lace,
But now it is troubled and happiness is gone,
For the bombs fell in that fine place
And the magician found when he had woken
His people killed, his gay pots broken.

1937

Fig. 33b. Same Plate as in Fig. 33a Printed in Relief

leather or rubber roller in the usual way. The plate, however, does not need to be cleaned as it is receiving a coating of grease. As the melting point of the ground is much lower than that of the hard ground, the plate is removed from the heater and the rolling completed cold. A definite brown color should be seen. A pale yellow film indicates that

POINT   LINE

PAPER
SOFT GROUND
PLATE

POINT + 2x PAPER THICKNESS
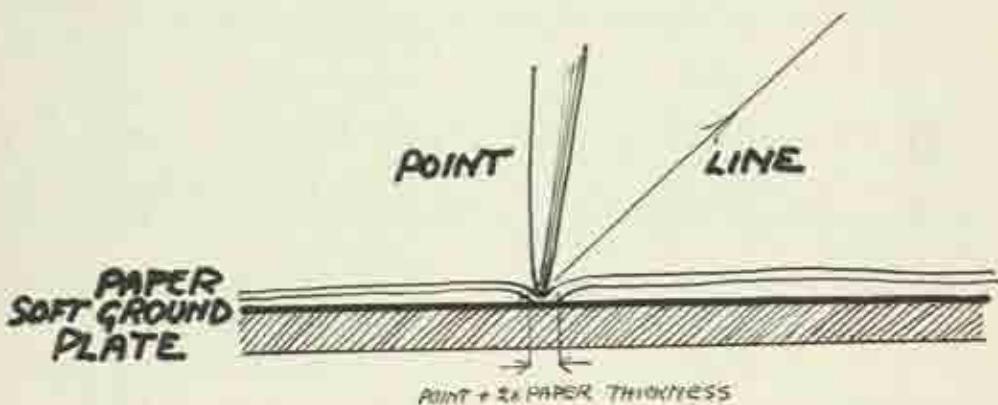
Fig. 34. Drawing on Paper over Soft Ground

the coating will not be strong enough to resist the acid, although, as will emerge later, there are times when a deliberately weak film might be used.

Work on the plate

The traditional method of using soft ground is to pin down a drawing (in reverse, the mirror image of a print), or a blank sheet of paper over the grounded plate and then draw on it with a pencil or a stylus. When the paper is lifted, its underside will have picked up the ground and exposed the plate wherever the pencil touched it (Fig. 34).

If we analyze what happens we see that thickness, texture of paper, and degree of pressure exerted will modify the result. Thus, the width of the trace on the plate will be the breadth of the pencil point plus about twice the thickness of the paper. The trace will have the character of the pencil line on the paper as the texture of the underside of the sheet is impressed upon the wax. The amount of the ground which has been lifted will depend upon the pressure applied, and not upon the blackness of the pencil trace on the paper. In all these methods it is important to try and visualize the mechanical

process of making the object, the metal plate with its capacity for holding ink, and confusion with the concept of drawing should be avoided. The consequence of each operation should then be clear.

Biting

The back of the plate, all errors or imperfections in the coating must be covered with stopping-out varnish. At this point it is possible to draw elements of white with the stopping-out brush through any strongly worked area. The plate is then bitten exactly like the bitten-line etching previously described, so that, of the lines established in the plate, some may be so little exposed to the acid that they are barely visible as grays, while others may become black and stand up in relief. As with bitten-line etching, the separation into elements of varying strength may be done by the addition of new work after biting, or by subtraction by means of partial stopping out at each stage. When biting is completed the plate is cleaned with benzene or another solvent and printed like a bitten-line etching.

As the surface is sensitive to any pressure, plates covered with soft ground must be handled by the edges. Also, before stopping out, the plate *must* be allowed to dry, a process which has been speeded up by the use of a hot air drier. Heating the plate is unwise as it can soften the ground and cause it to close up over the opened lines.

Plates made by this method have somewhat the character of lithographs or pencil drawings (Fig. 35). As, in fact, they have microscopic pits which hold the ink, in place of the furrows in the bitten-line method, they have an enormous resistance to wear in printing.

It seems strange that, given a plate prepared in this manner, artists would not have done the most obvious thing, which is to draw directly through the ground with a wooden or other stylus, or to press fingers, textures and so on, into it. Yet, until recently, this seems to have been little done. Some examples are: fingerprints in Fig. 36, textile in Fig. 38, textile and leaf in Fig. 46, canvas in Fig. 47, skin in Fig. 48.

Beginners, starting work in Atelier 17, are generally given a plate prepared in this way, and invited to draw freely, scribble even, upon the wax surface. As the hand cannot be rested on the surface they are compelled to draw freely. Generally a score of attempts are made, then obliterated with the roller, before anything is fixed by acid in the plate. In this way two useful qualities of the medium are appreciated at once.

Fig. 35. John Crome (1768–1821): The Tree. Soft-Ground Etching from Drawing
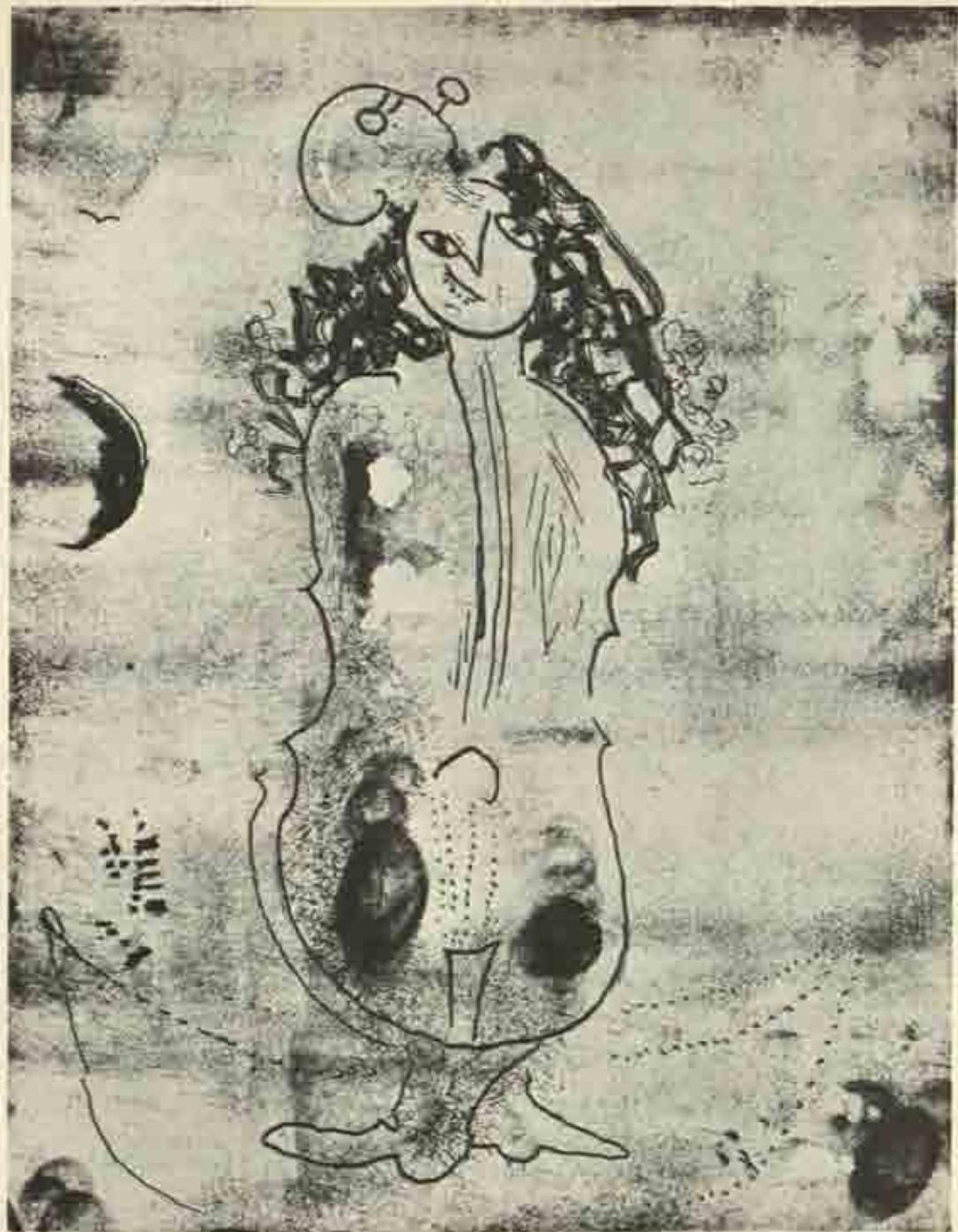
Fig. 36. Marc Chagall: Femme Violoncelle, 1944. Soft-Ground Etching

Fig. 87. Jacques Lipchitz: Minotaur, 1943. Etching, Engraving and
Liquid-Ground Aquatint

Up to the point at which biting is started there is an infinite possibility of change but, while the spontaneity of touch remains in the final print, a definite decision must be made at some point.

Even with this method it is possible to map out the design to be used. A pencil trace made on the plate before grounding will be visible through the ground and can serve to orient the design.

The method has also been used, with very exaggerated biting, to produce forms from which white relief could be printed (Fig. 123). Other uses of this coating on a plate will be described in Chapter 5 (Aquatint, Bitten Surfaces).

LIFT-GROUND ETCHING

A number of devices have been used at different times to evade the difficulties of etching by enabling the artist to draw directly what would appear on the print. Known as the "pen method," "sugar method" and other names they depend upon the same principles. Some substance is used to draw directly on the plate or even, in certain cases, on paper whence the drawing is transferred to the plate by pressure, so that the reversal of the design in printing is avoided. The plate is then coated with an acid-resistant film. When soaked in water or acid, the ground breaks down over the preparation used so that the drawn lines will be bitten. It should be obvious that the illusion of a direct method is only an illusion. Any method which involves the use of a substance that will cause the coating to lift, exposing the lines to the action of the acid upon the metal, and which then requires the application of ink and finally pressure to transfer that ink to the paper can hardly be called *direct*.

Most of the mixtures used depend on the fact that glycerine, gum arabic, sugar solutions, corn syrup, gamboge, etc., do not dry completely and consequently the film of ground over them will be porous. In a method used by Atelier 17 from 1929 on, India ink, mixed with about the same amount of syrup has been employed.

Other mixtures which have been found very effective are 2 parts ink, 2 parts syrup (sugar in solution), 1 part tincture of green soap and a trace of gum arabic, or 1 part gamboge, 1 part gum arabic, 1 part soap solution and a trace of glycerine. The soap in these mixtures prevents bubbling on the copper plate, and causes the ground to lift more easily. Ordinary gouache has been used as a lift ground, but it has been found uncertain in its action.

Fig. 38: S. W. Hayter: Palimpsest, 1946. Lift Ground, Three Colors

Fig. 39. Pablo Picasso: "The Lizard" from Buffon's *Histoire Naturelle*, c. 1937–38. Aquatint

In Atelier 17 it was noticed that the patterns made by the whiting in cleaning a plate were exciting and a plate with such markings was sprayed with fixative, lifted with acetic acid and then etched. The *décalcomanie*, used by the surrealists, can be done on paper with lift ground, transferred wet to the plate by pressure, grounded, lifted and etched as described.

The drawing is made upon the clean surface of the plate with a pen or brush using one of the mixtures described. The plate is then dried by heating and coated with liquid ground or with resin dissolved in alcohol. This is done by placing the plate in a tilted bath, pouring ground into the lower end, and turning the bath so that the liquid flows over the surface. The plate is then removed and stood up to dry. When dry it is soaked in warm water or, better, vinegar or acetic acid, until the ground detaches over the work.

In this state the plate may be bitten as described, or aquatint may be laid; we have even laid a soft ground over the opened design and pressed in textures such as silk, gauze, or crumpled paper (Fig. 38). In actual fact most effects obtainable by this means can be done more readily with the soft-ground method described (Fig. 36), although Roger Lacourière has employed the lift ground with excellent results in the preparation of his prints for Georges Rouault (Fig. 43), Picasso (Fig. 39), Braque, and Paul Eluard, the poet.

CHAPTER

5

ETCHING II: AQUATINT - BITTEN SURFACE - MANIÈRE NOIRE

Under the above heading have been classified all the methods in which whole areas of a plate are attacked with acid to render them capable of retaining ink in pits or irregularities of the surface. This is distinct from the methods of bitten-line and soft-ground etching already described, in which lines only are exposed to the mordant, the remainder of the plate being protected by the ground. The effect given by the processes under consideration is that of wash drawing rather than of pen line.

When an area of plate, without previous preparation, is exposed to acid a slight irregularity is produced in its surface as the attack commences, which will print as a slight gray. If the action of the acid is sufficiently slow, the grain developed in the surface represents the crystallization of the metal. When the acid produces bubbles of gas, these, if they are not removed, protect the surface under them from the action of the acid, so that ring-shaped patterns of deeper biting
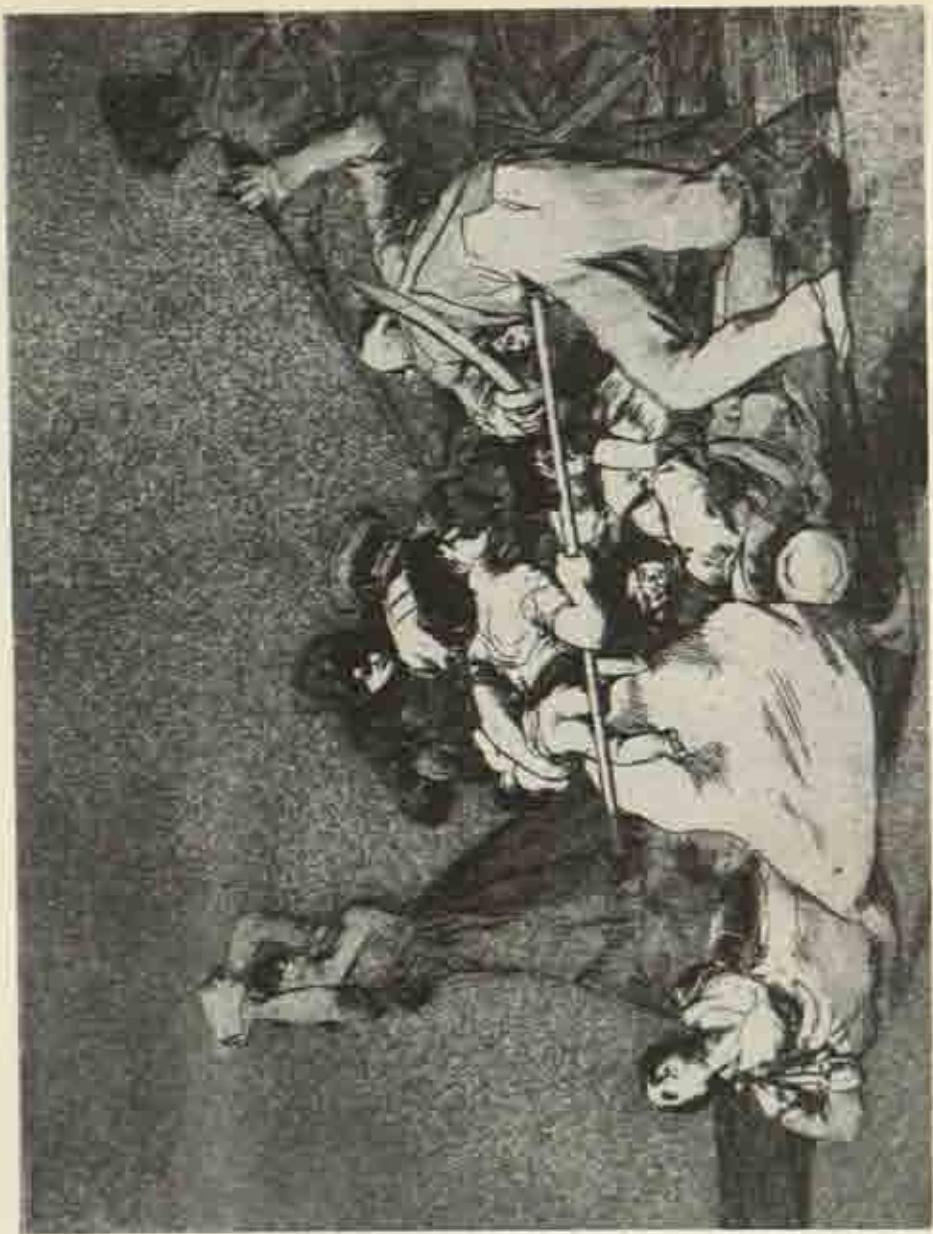
Fig. 40. Francisco Goya: Desastres de la Guerra. Aquatint

develop. This has been exploited to give a granular surface of varying intensity according to the strength of the acid (see Fig. 30). Further attack, however, will not darken this effect, it only causes the edges of the hollow, as it becomes deeper, to retain a wider and wider margin of black, leaving the center of the area unchanged in value. This area will print quite strongly in relief on the paper. Such spaces are known to French etchers as *crevés*, and often occur in strongly worked passages in line etching, where the intervals between the lines have been allowed to bite out (see Chapter 4, p. 93).

These areas can be employed in etching to give certain effects: the
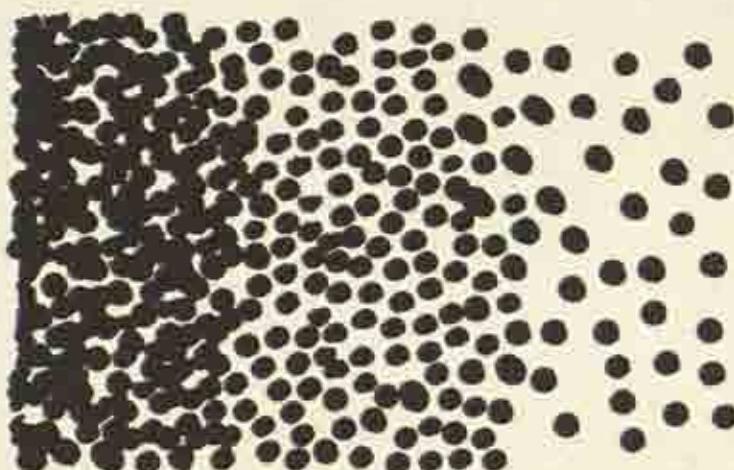
Fig. 41. Resin Ground

black margins obtained in this way give an effect of relief to an unworked area which they surround. There is a certain ambiguity to these effects. If the print is seen illuminated from one side, the portion that appears to project on account of the values of the black can be seen to be in reality lying at a lower level than the parts bitten away, the paper being a cast of the plate. When, however, it is desired to bite a series of values of gray to black on a plate, it is necessary to use some device to protect points all over the surface, or to produce a tooth which will retain the ink in printing, so that, as the acid deepens the hollows between them, a tone will be produced, increasing according to the depth until black is attained. One method of achieving this

end is known as aquatint. It was invented about the middle of the eighteenth century, but was little employed as a medium of original expression until Goya used it in combination with bitten lines at the beginning of the nineteenth (Fig. 40).

RESIN-GROUND AQUATINT

The zinc or copper plate is cleaned and polished and fine resin powder is deposited on it. The layer of resin dust may be applied by shaking a silk bag containing the crushed resin over the plate, in a situation sheltered from drafts. The cloud of dust settles on the plate and, with a little practice, it is possible to get a fairly even coating. The plate is then heated until the resin melts and adheres to the surface. Many artists prefer the effects given by this method to the more mechanical tone of others, as it permits intentional variations of grain, and even values in the plate. Thus, if the amount of dust in one part of the plate is sufficient to melt together when heated, a white will appear in that part, fading to gray as the grain becomes more open (Fig. 41). Interesting textures have been produced in Atelier 17 by using very large, irregular pieces of resin, the coating sometimes being applied in two successive stages.

Another method of depositing the resin for larger plates or where great uniformity of grain is required is to employ a box in which a large space above the plate is filled with a cloud of dust which slowly settles on the plate in an even coating. One type of box shown (Fig. 42) is a zinc-lined case with a drawer near the bottom in which slides a tray of wire netting to carry the plate. Through the hole a pair of bellows are inserted and the cloud of resin dust is blown up with the drawer closed. After a moment, to allow the heavier particles to settle, the plate is put in rapidly and the drawer is closed. At the end of a few minutes, a regular deposit of resin dust has settled, the amount depending upon the length of time the plate remains in the box. The plate is then removed, great care being taken to avoid disturbing the deposit, and it is heated until the points of resin melt and stick. The plate must not be tapped against anything as the jarring will cause the grains to clot, and it also must not be too strongly heated, otherwise the resin may be burned off. Very elaborate boxes are made for

100

process engravers in which the cloud is obtained by means of fans, with grinders for resin and graduated sieves to control the size of the grain. These, however, are not really needed for original aquatint.

The quantity of resin needed depends upon the grain being sought
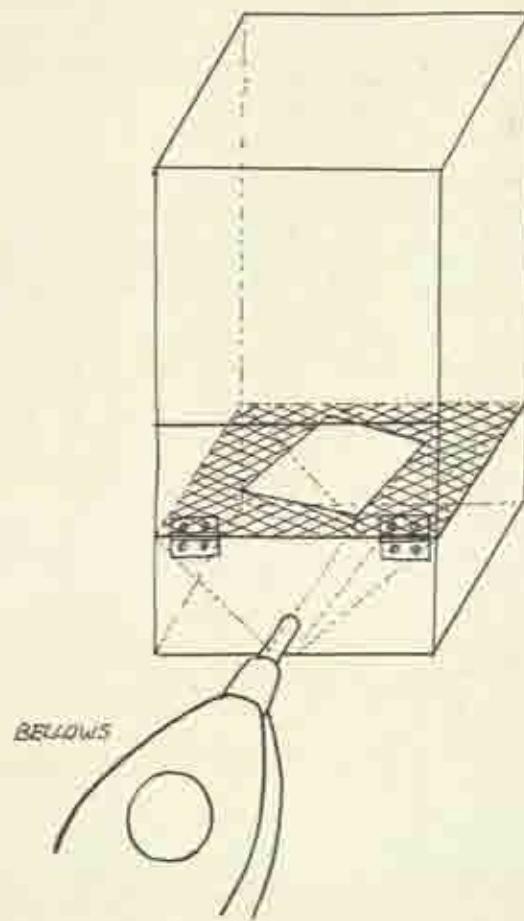
Fig. 42. Aquatint Box

for in the work. Too little resin will give a coarse grain, leaving perhaps 90 per cent of the plate unprotected, which will be weak mechanically and wear after one or two pulls, showing the poor quality of a *crevé*. As the quantity of deposited resin dust increases, the grain becomes progressively finer up to a certain optimum where perhaps only 60 per cent of the surface will be exposed to the acid. This point can

only be determined by experimentation on the part of the etcher. Beyond this, more resin will result in the clotting of the specks, and when more than 50 per cent of the area is covered, the grain will be coarser again. In this case, as with sand grain etching and soft-ground collage methods, points are being bitten into the plate, leaving the greater part of the surface intact to withstand the pressure of printing. Such a plate will have an enormous resistance to wear. It is for this reason that the original plates of Goya, where the resin grain is of this type, were printing almost as well as when they were made when I saw them in Madrid in 1937, after one hundred years and after several badly taken editions.

When the plate is cool the portions which are to remain white are covered with stopping-out varnish. The colorless solution of resin in alcohol, recommended in Chapter 1, is excellent for this purpose, if used carefully, as it enables the values of different bitings to be compared in the acid. As the varnish is only just visible, great care is necessary to avoid leaving holes in it, which may in the end print not only gray but even black. Many beginners use a careless stroke of the brush in stopping under the impression that they are painting and that the boldness of the stroke will give boldness and simplicity to the result. They are *not* painting. In practice a strong, bold effect is generally the result of extremely accurate and meticulous stopping. Between the careless strokes of the brush innumerable tiny triangular openings may be left which, far from giving a bold effect, show a certain meanness, and detract from the effect sought by the artist.

Aquatint obviously lends itself to the use of white line effects on gray or black. These effects are very precious yet they are seldom seen employed. Stopping can be done with lithographic crayon or a dry brush to give an effect like chalk drawing, and carbon paper has been used to give a white traced line on aquatint in the same way.

It is unusual to see aquatint employed alone on a plate as it is very difficult to find the position of the elements of the design on the plate. The line that mixes best with the quality of the aquatint is perhaps the soft-ground, although bitten line or even burin line are sometimes used. In the absence of such lines it is convenient to transfer a drawing on to the plate with chalk applied to the back of the sheet, as this shows strongly enough to guide the brush in stopping-out, and is removed by the action of the acid. In any case it is so easy to forget ele-

102

Fig. 43: Georges Rouault: "Weary Bones" from *Le Cirque de l'Etoile Filante*, 1934. Color Etching
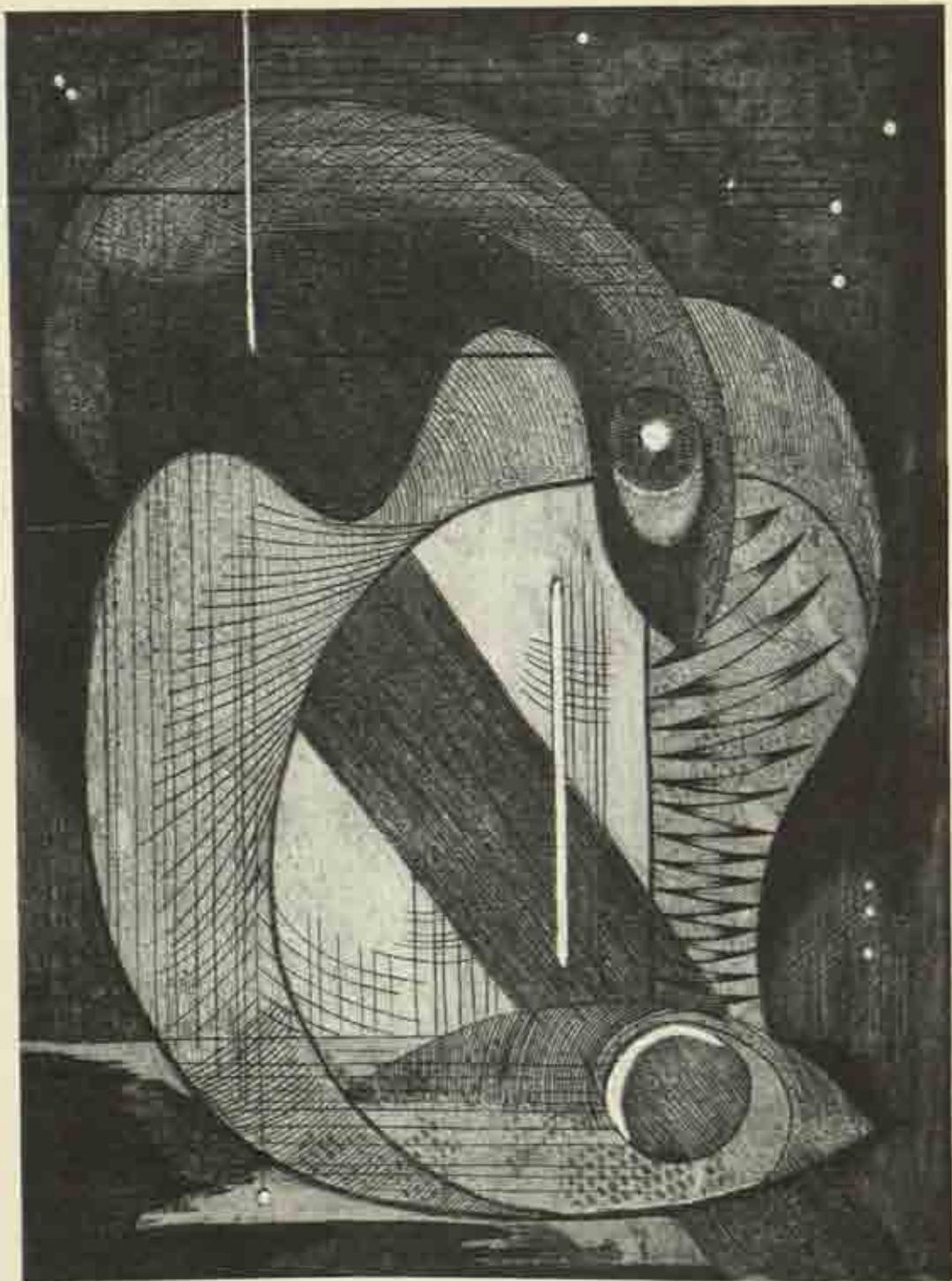
Fig. 44. Philip Kaplan: Ophidia, 1946. Soft-Ground Etching and Engraving

ments in stopping-out that it is well worth-while preparing a drawing in which the areas of tone are numbered from I, white, to N, black, and which can be used to verify them before each biting.

Biting

The action of the acid resembles that in the case of bitten line already described but, as far more surface is exposed to acid in proportion, and as far less depth of attack is required, it is prudent to use weaker acids and watch the action very closely. For zinc it is recommended that no stronger acid should be used than 1 part nitric to 12 water, and, for copper, Dutch mordant or smillies or dilute ferric perchloride. The last of these, which deposits black copper oxide on the bitten surface, is preferred by some etchers as showing up the values immediately, in the bath.

Again the degree of biting can only be estimated after some experience of the method, for the time varies so widely according to the temperature and other circumstances that it is of little value as a guide. A general rule, as with bitten line, is that the intervals for a tone increasing regularly in value will follow a more or less geometrical progression as $1:2:4:8:16$, etc. In the earlier stages of biting, the plate, in the acid, shows *more* difference in intensity than it will really print, while in the latter stages the difference in the print will be greater than it appears in the acid. Thus, for the concluding stages, the difference between dark gray and black is best estimated by feeling the depth between points with a needle, as hardly any difference is visible while the plate is in the bath.

An imperceptible increase of tone across an area can easily be obtained by placing one edge of the plate in the acid in the bath which has been tilted, then lowering the bath and letting the acid progress slowly towards the lightest part. A hard edge is avoided by keeping the liquid in motion by blowing gently on it. If a number of such variations of tone are needed in one plate, it is necessary to reground it for each one, everything else being stopped out each time. Spotting and variety of tone can also be produced by applying the acid to the plate with a brush, and, if a very soft gradation is required, the plate may be wetted before doing this.

It is possible to rebite an aquatint if a very fine ground is laid the second time. This should be, if possible, closer in grain than the first. If the ground is coarser than the first the points will show for each

Fig. 45. Marc Chagall: Acrobat with Violin, 1924. Etching and Dry Point

unit of surface the lowest common denominator of the number of points per unit in the two grounds. Thus, bad *crevés* may appear and a value may bite lighter instead of darker following the removal of the original points. I have rebitten an aquatint by regrounding it with hard ground as has been described under bitten-line etching, but this is only possible where the area has already been strongly bitten in the first state. For slightly worked areas it is necessary to reground with the resin. Aquatint plates are, in most cases, fragile and one should try to arrive at the complete result with as few trial prints as possible, having the plate steel-faced before printing the edition.

LIQUID AQUATINT GROUNDS

Another method of producing the porous ground required for aquatint consists in coating the plate with a very dilute solution of resin in acid. The saturated solution of resin which is used as stopping-out varnish, if diluted with about ten times its volume of alcohol, will dry on the plate leaving a very regular granulation. It is possible to vary the size of the grain by using different dilutions of the solution, and the nineteenth-century reproduction etchers could get very fine and regular grain by this process. A mixture of the solution with water will dry to a coarse grain. Asphaltum has also been used in the same way as resin. It should resist acid perfectly but, I should imagine, would tend to flake off more readily if carelessly handled.

SAND GRAIN AQUATINT

In this method, instead of leaving the surface of the plate open and reserving points to hold ink in it, the surface of the plate is protected with hard ground, as for bitten-line etching, and an infinite number of pin holes are opened in it, for the acid to attack and enlarge, thus darkening the tone. The usual method of doing this is to pass the plate, with a fine sandpaper over it, through the press with a light pressure. As the finest sandpaper is still coarse in grain compared to the scale of the work, it is usual to pass the plate two or three times, changing the position of the paper each time, to multiply the number of holes. Biting and stopping-out are done exactly as in the case of the resin-ground aquatint, except for the difference in biting due to the smaller
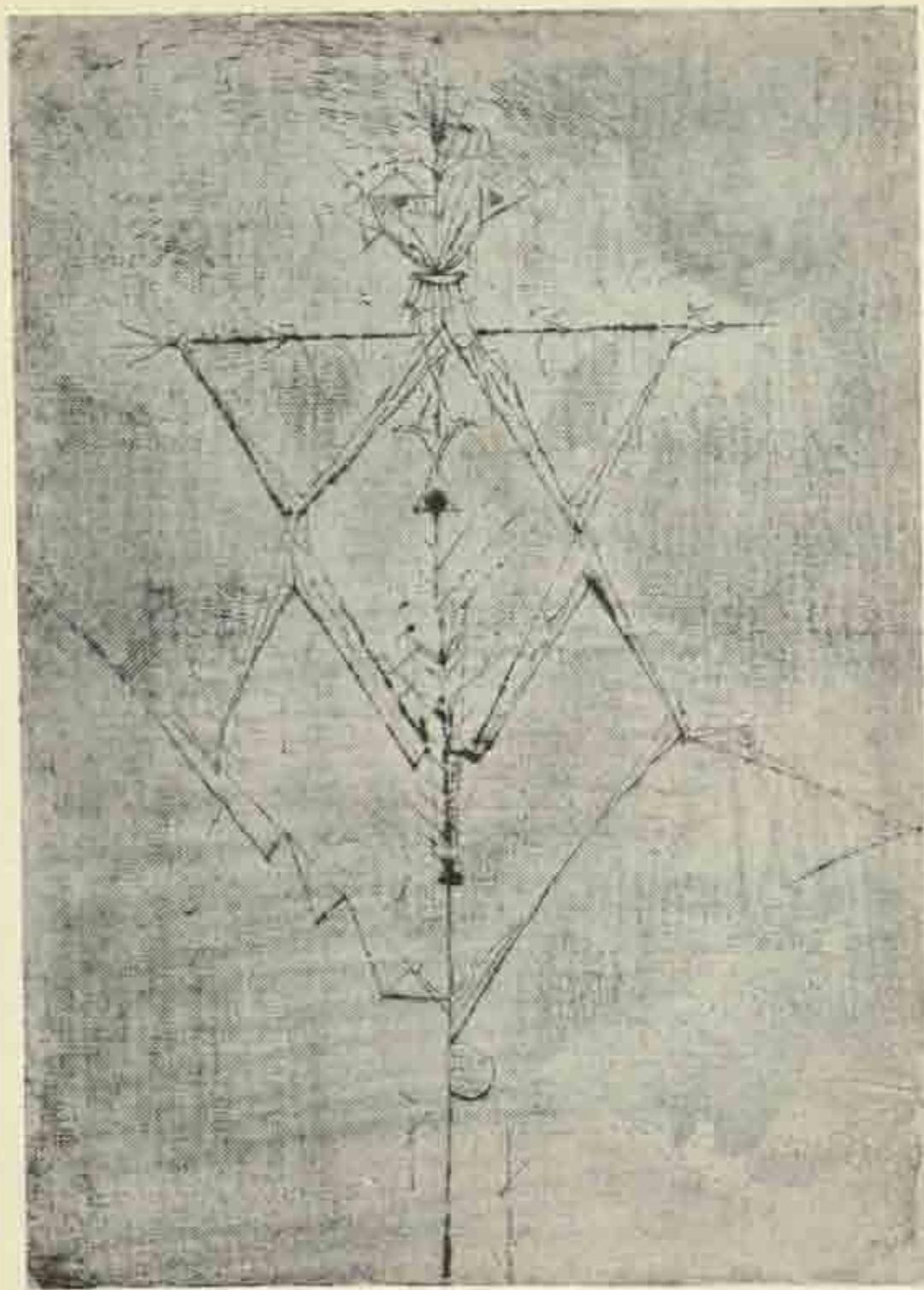
Fig. 46. André Masson: Le Petit Génie du Blé, c. 1942. Soft-Ground Etching

Fig. 47. James Gillray (1757–1815): Caricature. Etching with Textured Background

percentage of the plate surface which is exposed. It is difficult to estimate the values of sand grain aquatint. The method has the definite disadvantages that, without extreme care, the whites are blurred by the sand grains being forced into the plate, and it is hard to achieve precision in stopping-out. The plate, however, is extremely robust and will give fifty prints without steel-facing. A method which produces very similar results is that described by Stapart (Paris, 1773), in which salt is sifted on to a thin ground kept fluid by heat. On cooling the salt can be dissolved in water, leaving a porous ground. A very slight cloudy tone, dissolving to white at the edges, has been made by sifting finely ground sulphur on to a plate, heating it and removing the sulphur with a solvent. It is possible to increase the depth of such slight tones, which are due to the formation of copper sulphide, by exposing the plate, after heating, to a very weak solution of hydrochloric acid, when the copper sulphide is etched out without affecting the copper outside the area. Again a paste of sulphur and oil has been left on the plate overnight with similar result.

BITTEN SURFACE: IMPRESSIONS OF TEXTURES ON SOFT GROUND

A method we have applied for purposes similar to aquatint, or to collage, or for purposes referred to in Section 3 of this book, is the application of a tissue or other texture to a soft ground (see Chapter 1, Materials).

When a plate coated with soft ground is passed through a press, under a pressure much lighter than that needed for printing, with a layer of any material with an irregular surface over it, the ground will adhere to it and be removed by those parts of the texture where the pressure was greatest. This use of quite flexible materials obviates the danger of marking the plate as in sand grain. The choice of materials is wide. We have used silk, net, gauze, lace, wood veneers, leaves, bark, leather, crumpled paper, cellophane, skin, the hand, and innumerable other substances (Figs. 46, 47, 48). It is quite possible to assemble on a plate, one by one, a series of contrasting textures bitten gray to black according to the length of time each area was exposed to the acid. White lines can be drawn through such areas before biting, and black lines be cut through them by etching or with the burin before or after biting. These textures will be transparent, as they leave more

than fifty per cent of the surface unattacked, which thus remains available to take further textures. Three or four of these textures can then be seen one through the other as if they were overlapping transparent films. Furthermore, at each stage all previous work is sealed up by
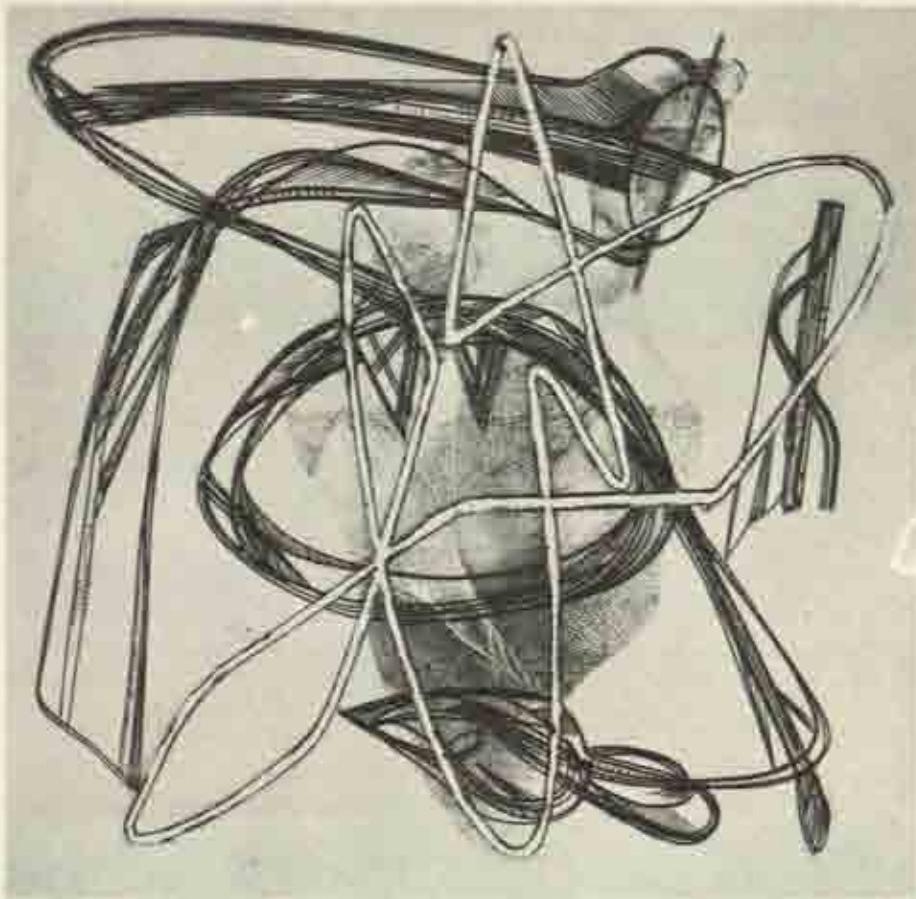
Fig. 48. S. W. Hayter: Oedipus, 1934. Engraving and Soft-Ground Etching

the ground and consequently not attacked. The limit to the multiplication of such layers is reached when one arrives at black, that is to say, when no unbitten surface remains to take further impressions.

In biting such plates, as with all other uses of soft-ground etching, the plate must be allowed to dry each time before stopping-out. A hot air drier of the sort used by hairdressers is useful for saving time in such work.

111

Even after the impression has been made on the soft ground the effect can still be varied by the treatment of the plate in the acid. Thus a texture of the sort obtained by pressing crumpled paper into the ground contains every variation from open surface to completely sealed surface; that is, from black to white in the proof pulled after biting. Rapid biting with strong nitric acid will develop the open traces very strongly but will not attack the very delicate halftones at all, while a slow biting with Dutch mordant will develop very delicate shades of difference in the texture. Thus, from the same transferred texture, it is possible to produce a thread-like black web seen over white, or a full texture like a membrane, according to how the plate is bitten. Similarly, when very soft ground is used in a thin layer, every least variation of pressure will take effect, but the whole range of values over the texture will be gray and uniform, and the difference between dark gray and black will almost disappear. Should, however, a harder ground be used, only the stronger impressions will take effect, but they will be clearer and less blurred. Negative textures can be made by pressing a sheet of paper on to the ground through the original texture, and then rolling this paper on to a blank plate.

To obtain a ground for the same purposes as aquatint, that is, to bite in a series of values, I have replaced the soft ground by a hard ground passed, while warm, through the press with a silk texture. In this method, should the texture used be fragile, it is wise to heat the plate gently to remove the tissue. The final result is a solid ground that can be handled freely and dried between bitings and stoppings with a blotter if required. All these processes have great advantages over the resin-ground aquatint. They produce a plate that has a greater capacity for withstanding wear. The values are transparent in comparison with those produced by the resin-ground, and the resources of texture which, in a black-and-white medium, replace those of color in painting, are far wider.

A somewhat similar method of obtaining an open surface on a plate is, with a wire brush, to open an enormous number of lines in one direction on the grounded plate, and then to proceed with the biting as in aquatint (Fig. 15). The effect will be a series of grays with the direction of the original striations, passing through everything.

112

This is a method which resembles those described in general principles, but the execution is more regular. Closely-set parallel lines are ruled on a grounded plate in at least four directions, vertically, horizontally and diagonally. The plate is treated like an aquatint and bitten in any series of values desired. The effect is much harder than that of ordinary aquatint and it is remarkable that it is not more often employed.

All of these methods permit of drawing in white on black, or gray on black, as the term *manière noire* describes the last of them. They are, unfortunately, often used to produce night scenes, as, equally unfortunately, dry point is used for snow scenes or fog effects.

For making a series of plates to print in color, either as surface or intaglio prints, Fred Becker has devised a very ingenious method of transferring a very complicated image to all the plates so that they will register correctly. The image is cut with burin, point, or scraper into the surface of a sheet of celluloid, plastic, or scratch board. All the plates are coated with soft ground and the impression of the sheet is taken on each. Then, by stopping-out on the different plates, the required colors and forms can be made to appear where they are needed.

It is sometimes useful to stop by means of a cut profile rather than a painted-out form. To achieve this we have cut out forms in thin *celluloid* (or an acid-resistant plastic), which are laid on the soft-grounded plate with the texture over them. If the soft-ground coating is heavy enough they will adhere to it, and will act as stopping, permitting the texture to take effect only outside the area they cover.

Another method by which slight aquatint tones with extremely fine texture have been bitten in a zinc plate was tried recently. Used Dutch mordant containing copper in solution (or old nitric acid containing copper) was applied to the open surface of the plate, with a brush as in the 'spit' fashion described, and also for a short interval in a bath. An aquatint tone was given by the very fine granular deposit of copper upon the zinc; an attempt to carry the biting further in a zinc bath failed as the electrolytic effect of the zinc-copper couple removed the grain, resulting in a *crevé*. Thus though the system could be used like the sulphur method for light tones, it is not practicable for strong bitings.

However it seems that an extremely fine electrolytic deposit of chromium or nickel on a copper plate might be used to establish a grain finer than that possible with the resin powder which would resist the action of the acid to any required degree. In this case the grain would be too fine to be perceptible to the naked eye.

CHAPTER

6

PRINTING I: PRINTING FROM INTAGLIO PLATES

Before the result of the artist's work on a plate can be seen at its true value, it has to be printed on paper. Printing from intaglio plates is capable of so many variations and possesses such a richness of quality that, unless it is fully mastered, a poor presentation of the work will destroy much of the value it should have.

The quality of the paper, its dampness, the color, texture and consistency of the ink, the temperature to which the plate is heated, the touch of the gauze or the hand in inking, and finally the degree of pressure, with the quality and conditions of the blankets, are all factors which will modify the results. For any particular plate there is an optimum for each of these factors: when that has been found the result will amplify every quality in the plate. Without the correct conditions, a surface which should print as silk will have the quality of chalk, many lines and textures will not appear at all on the print or they will appear with such poverty of effect that they will no longer contribute anything to the result.

The touch of the hand of the printer, *le coup de main*, is a character-istic of the individual and can only be developed with years of practice. It is easy for the expert to distinguish between two prints of a Meryon plate and declare which one of them was printed by Delâtre, even in the absence of the printer's signature. An apprenticeship of five years is considered necessary for a printer to qualify as a journeyman, and in a big printing shop there is always one master printer, to whose twenty years or more of experience the journeymen appeal when some-thing occurs which is beyond their comprehension.

The calm, the economy of gesture, the sureness of hand of an ex-perienced printer, his care for and organization of tools and materials are all worthy of study, and of admiration. Every proof made should be perfectly printed on good paper. There is *no such thing* as a "rough trial print." Even to verify two lines on a plate, it must be printed just as well as the final prints which are to be shown.

THE PRESS

The design of the roller press, used for printing from intaglio plates, has not changed essentially since the seventeenth century. It consists of a heavy steel bedplate running between upper and lower rollers in a steel or heavy wood frame. Some means of increasing the pressure upon the bearings of the upper roller must be provided, and, normally, two set-screws are used to supply this pressure, but when no screws are supplied, the pressure is changed by packing in more or less thick-nesses of cardboard or fiberboard. The lower roller, made of hollow steel, some 9-12 inches in diameter, turns freely in bronze or hardwood bearings. The upper roller is of solid steel and is at least 6 inches in diameter, its spindle being at least 1½ inches. The surface of the roller is level and perfectly concentric. Even a roller of this size will give 1/1000 of an inch or so, under the pressure used to print, so it should be obvious that smaller rollers or more slender spindles will be quite ineffective. Small presses, with three- or four-inch rollers, made to work on a table, are, in my opinion, toys: even small prints cannot be printed well on them, so that the user is never able to discover the real qualities of printing.

The bedplate must be at least ½ inch thick and perfectly flat. Some-times it is made with a bevel at one end to make it easier to remove.

PRESSURE SCREWS

FELTS

PACKING

ROLLER

BEARING

ROLLER
BEARING

PAPER BED

STOP

FRAME
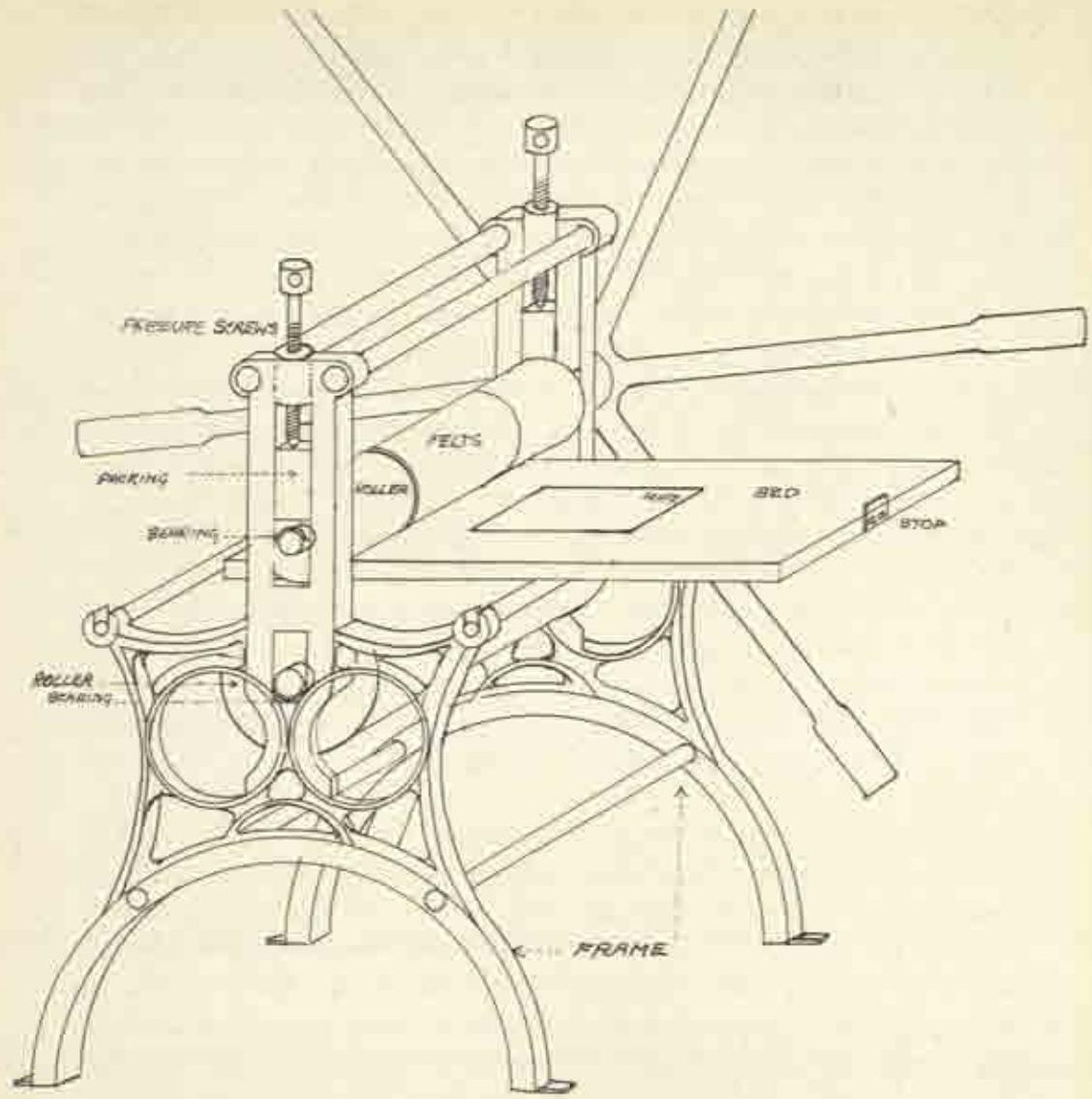
Fig. 49. The Printing Press.

At both ends stops should be provided on removable screws to avoid overrunning the press. Many printers use a thin sheet of zinc or, better to facilitate cleaning, chromium or stainless steel for this purpose. The bedplate is carried on the lower roller.

On many presses the ends of the bed are supported on small rollers and sometimes rollers are fitted to the frame to prevent lateral movement of the bed. Often a central ridge on the lower roller engages with a groove in the underside of the bed for the same purpose.

The upper roller may have bars attached to its spindle at one end, so that it can be rotated directly, or it may be driven indirectly through a train of gears, so that the crank or wheel turns at about three to five times the speed of the roller. The pressure needed to print is of a certain intensity per inch of the cross section of the plate: thus, any press with a bed wider than 16 inches will need to be geared unless the printer is exceptionally strong. If we analyze the forces exerted on the roller, it also becomes clear that a very long roller will show some torsion when driven from one end only. This would cause slight slewing of the plate and a consequent doubling of the impression if it were passed twice. So, very large presses have a double train of gears to drive the roller from both ends. I have a personal preference for a directly driven press, as the pressure on the plate can be felt when printing.

Before printing can be attempted, the press must be set up and adjusted. No engraver can pretend to know how to print unless he can do this. In Atelier 17 it is our practice to unscrew the adjusting screws so that each printer has to set the pressure for himself before starting work. Once the pressure has been determined, marks with paint can be made on the screw threads and on the frame which, when brought into alignment, will indicate the correct pressure and save time in resetting.

Setting up the press

Once the frame of the press has been assembled, bolted firmly together, standing on a level base, and the bearings have been greased, the first step is to verify the balance of the bed on the lower roller. Releasing the pressure on the set screws, one should sight under the bed to see if any light can be seen between it and the lower roller. If light can be seen, the roller is too low and must be raised before start-

118

ing to print. This is done by lifting its weight with a beam used as a lever. It is then held up with blocks, while cardboard shims are fitted in the slots under the bearings, and the roller is then lowered back into position. Where rollers on the ends of the frame are provided to support the bed, the bed should be in contact with these rollers at one end *only*, and with the large bearing roller just *clear* of the rollers at the other end. Then, when pressure is applied and the shims are compressed, the bed will be perfectly level, being neither convex nor concave, and borne chiefly by the big roller, before pressure is applied. Unless this is done the plate will buckle, the pressure will be unequal along the length of the plate; and poor-quality prints will be the result.

Adjusting the pressure

The plate to be printed is to be laid face up upon the bed of the press, covered with prepared paper and with two or more blankets. These blankets, of closely woven pure wool of the finest quality, are extremely expensive, but only the finest should ever be used. They should be treated with the greatest care, as that layer of blankets which actually makes contact with the back of the paper determines the texture of the background. This blanket should be clean, resilient and of the finest obtainable "roller cloth," or "swan cloth." One or more coarser blankets, or even felts, above it serve to give it resilience. Whenever these blankets become damp or stiffened with size from the damp paper, they must be changed. Should they be damp they must be dried, if stiffened with size, washed with lukewarm water and soap or soap powder. A little ammonia added to the water aids in washing them.

Many printers use blotters over the paper which is to take the print, but unless the nature of the paper makes this necessary, I consider it undesirable, as the finest texture for printing is wool felt and not paper pulp.

The press is turned until the roller is on the felts, but not on the plate or the paper. The set-screws are then tightened by *hand* until they seem to have about the same pressure. To verify this, the clean plate is set up on the bed of the press, covered with a sheet of blotting paper and then rolled through the press. When the paper is removed it should be examined with light parallel to its surface, to see if the two edges are exactly alike, and if every line in the plate appears

119

white in relief. If any inequality appears, it is corrected by tightening one of the screws. Should a weakness be seen in the center of a big plate, this is compensated by sticking a piece of paper to the back of the plate, the thickness of the paper being varied until a perfect impression is obtained on the blotting paper. The press is now ready for use.

PREPARATION OF THE PLATE

The plate is placed on a hotplate, heated electrically, or with gas, alcohol or even hot water, and brought to a temperature on which one can just bear to place the hand. Ink, which has been prepared as described on page 128 f., is put on a glass, marble or slate slab, and, oil being added if necessary, is well mixed with a palette knife. The consistency of ink needed to print a plate with the best results has to be determined by experiment. Dry point generally requires a denser and stickier ink than burin, which requires a more liquid ink containing some raw linseed oil. Generally, the mixture should drop slowly from the palette knife when it is held up, but it should never drop in a continuous thread. Ink is taken up on a tampon (described in Chapter 1) or roller and is applied all over the surface of the plate. In order to make certain that the ink is driven into every crack of the plate a hammering or rocking motion of the dabber can be used without danger. It is necessary, however, to avoid a screwing or sliding motion of the tampon, for, although every precaution has been taken to obviate the presence of grit in the ink or on the tool, a grain may be present which would scratch the surface of the plate.

The plate now shows a uniformly black surface and, turned against the light, should present no bright and uninked lines. If such lines can be detected, a rag or the fingers worked across their direction will fill them.

Wiping the plate is then started. This process requires the use of three pads of gauze. Tarlatan or starched mosquito netting, as described in Chapter 1, is the best for this purpose. If two degrees of fineness are used, it will make the printing easier. The first pad is one already wet with ink and it is used with some pressure in a rotary movement to ensure all work being filled with ink. At this point no attempt is made to remove ink. The second pad, of open grain, is used

120

in a rapid circular motion, employing the *least* possible pressure, until the design of the plate is clearly visible through the ink.

Professional printers often use a new pad which they are getting into shape at this point, for no pad used on a plate should be too stiff, nor should it be entirely free from ink. At first it may seem impossible to clear the plate without pressure. However, it is the light pressure that removes the ink. By increasing the pressure it is possible to put ink back on the surface.

The third pad, of finer gauze, should have some ink in it, or even dried ink on it. Using the same rapid motion, with *extremely* light pressure, the wiping is continued until only a slight film of ink remains on the unworked surfaces. At this point the lines should show a slight halo of tone, the film of ink over the whole plate should be uniform, and visible against the light as a bluish or purple film, and it should be free of streaks or spots. If a perfectly clean pad was used the film will show such blemishes and the print which is made will be poor and cheap in quality. Where white in relief is being used, these hollows may be cleaned at this point with a rag, on a stick if necessary.

A print can now be made. Such a print is a little hazy but very dense and is known as a ragwipe print. Bitten-line etchings and dry points are often printed in this way. Burin engravings and heavily bitten etched or aquatint plates, where a maximum of definition is required, need to be hand-wiped. The action employed in this takes some practice to master (Fig. 50). The dry palm of the hand is passed, rather relaxed, lightly across the plate with a wide sweeping movement, starting and ending clear of the plate. The point where one starts or ends the movement, if on the surface of the plate, will leave a hand-print. The commonest error in hand-wiping, as in rag-wiping, is the use of too great pressure, for even the weight of the hand is too much. The sound made by the hand using correct pressure is rather like that made by a stiff broom in sweeping. If the hand bumps on the surface, if it makes a sound like rubber on a glass, or if it whistles, then the pressure is too great.

The plate is rotated during the wiping so that the strokes pass in all directions, rather across than along the directions of the main lines. It should be emphasized that the preciousness of the quality and the texture of the print depend absolutely on the mastery of this action. Again, as in the rag-wipe, a film of ink is left on the surface of the
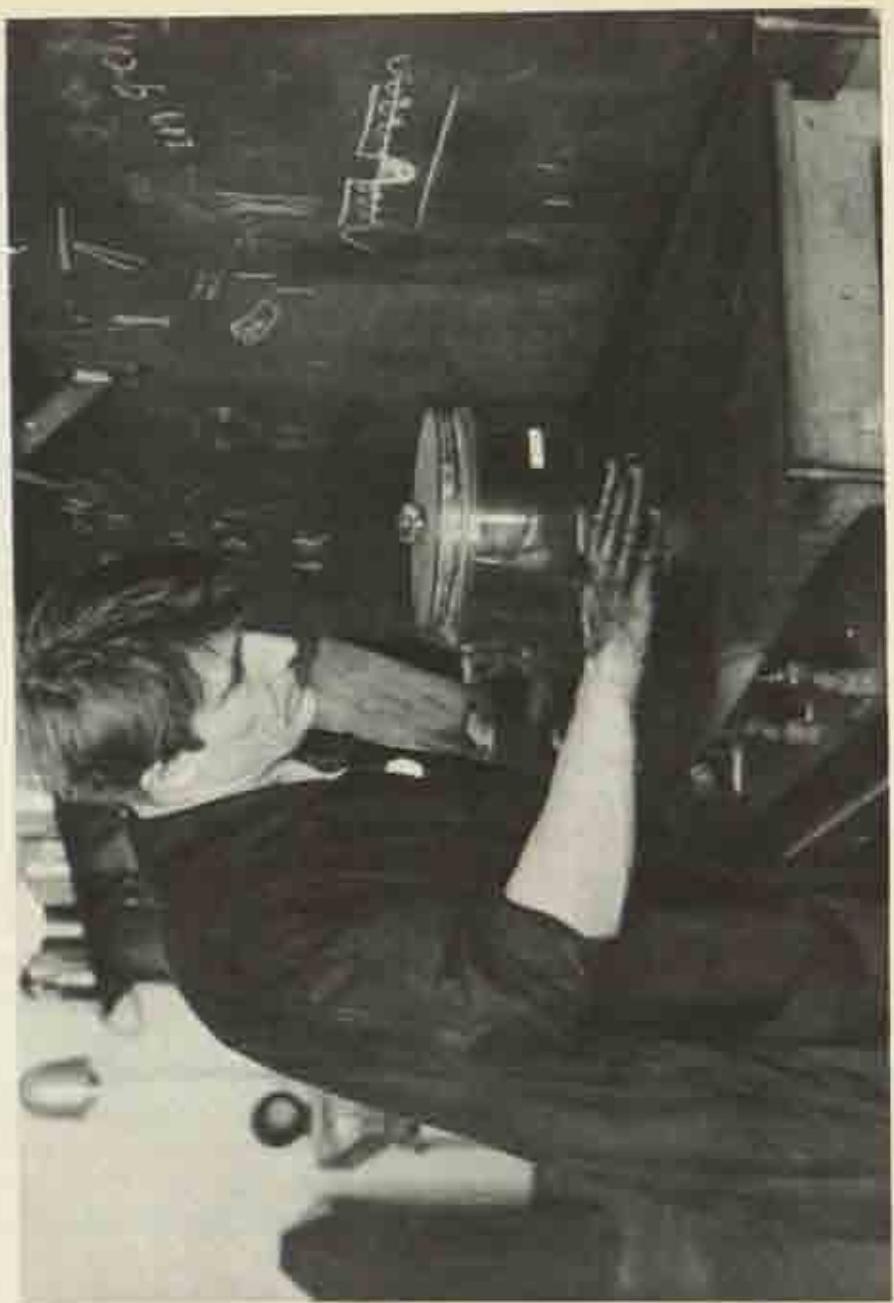
Fig. 50. The Author Hand-wiping a Plate

print: this depends for its density on the amount of light oil in the ink, the temperature at which the plate is wiped, and the degree to which the wiping is carried. The effect in the print is modified by the pressure of the press and the humidity of the paper.

Many printers dry their hands with whiting. If this is done the whiting should be completely wiped off before touching the plate, otherwise the color of the ink that is left is poor. The presence of whiting also has a tendency to remove all the film and leave a blank white background. By using an ink with a considerable content of light oil and preparing the plate as hot as it can be handled with a minimum of strokes in hand-wiping, it is possible to print a clear line on a background dark enough to convince most etchers that the plate has been aquatinted to a middle tone.

It is obvious that these different treatments can be applied to different parts of the plate so that, while certain parts of the work are veiled, other parts stand out in strong contrast. There is no objection to using such treatments but when, as with a whole school of etchers in England, the underworked plates depend entirely upon these methods of printing, it seems only fair that the proofs should be signed by the printer as well as the artist.

It is possible to combine the two methods of hand-wiping and rag-wiping by dragging a loop of soft gauze, slightly moistened with ink, over the hand-wiped plate, when ink will again be drawn out of the lines. This method, known as *retroussage* in France, is often applied to obtain liquid effects and increase the density of aquatint blacks.

Finally, the outer edges of the plate are wiped clean with a rag on the finger or with the hand.

IMPRESSION

The plate, prepared as described, is placed in the center of the bed of the press. Should it be of any size, the long side should be parallel to the length of the bed. The edges of the plate should have been beveled before preparation for printing began. If the plate is thicker than 1/16 inch, or if it is very small, it is wise to place one or two blotters under it. As these compress under the plate they will equalize its thickness to some extent.

The damp sheet of paper is then placed over the plate, its correct

position being determined by lines marked with pencil on the bed of the press. Should water be visible on the face of the paper, it should be dried or brushed lightly until it has been absorbed. It is important that the paper should be flat and that it should be uniformly damp, as a sheet which is dry on the edges will contract and pleat when printed, and such a printing fold makes an unusable proof.

The blankets are then pulled flat over the whole and the press is turned slowly, without stopping, while the plate is actually under the roller. Stopping while the plate is under the roller can cause irregular bands across the proof. The press is turned slowly to give the paper time to take a firm hold on the ink and, for the same reason, the plate is frequently passed twice. Printers making large editions often fasten the blankets back with a cord and weight, so that when the plate has gone through and back they do not have to be handled. In practice it is faster to do this than it is to walk around the press. In running a plate twice through the press, however, it is important to be sure that the pressure is balanced on the two sides and that the paper does not deform, as any inequality will cause the plate to twist slightly, resulting in a double impression on one edge of the print. This fault is not uncommon in prints, and I have seen Rembrandt First States showing doubling of this kind.

Finally, the print is removed from the plate. This must be done slowly and progressively, as a print, pulled carelessly from the plate, may cause a thread of ink in the lines to break, or, in the case of very soft-surfaced papers, to adhere to the plate and tear away from the proof.

Drying the proofs

The damp sheets are commonly dried between blotters, sometimes each proof being covered with tissue paper to avoid offsetting. Generally it is wise to leave the weight of the stack of blotters only on the proofs for 12 hours, after which they can, to some extent, be loaded so that, although the sheets dry flat, the plate impression and the relief of the lines above the surface will not be flattened. Another, and more rapid, method of obtaining flat prints depends on the fact that all rag and good fiber papers stretch when damp and contract when dry, to an extent of about 2 per cent in some cases. So, if the outer edges of the paper are taped down on a board, the contraction in drying will

124

stretch the proof quite flat. Although this is the most convenient method of getting a flat proof in a hurry, it will often remove the plate mark and, when raised whites have been used, they may be stretched so as to lose their relief. The whole procedure of drying and flattening prints is necessary because only that part of the sheet actually on the plate has been stretched by the pressure of the press, and, as the margins would normally return to their original size, the dried print surface would be convex and irregular. Both methods attempt to equalize the strains in the paper fiber, and if carried out correctly, will result in proofs which will remain flat, even if wetted and re-dried.

The paper will, as a rule, dry in about 24 hours, but the inks we use will not be safe to handle for at least 48 hours and the oils in them will not have entirely ceased to oxidize for a year or so.

Discipline of press room

The elaborate means described to produce clean, perfect prints may seem too complicated, but, without serious organization of the whole process, the work will not be presented at its true value. Wet paper, ink, wiping pads, felts and blotters, solvents, cleaning rags, cleaning table, all must have their places and all must be kept clean. The printer's hands are going to be covered with ink in the printing, yet paper, blotters, blankets and the bed of the press must be absolutely spotless. This is done by the use of metal or stiff cardboard clips, called *les mitaines* in France. These are made by folding pieces of 4 inch by 6 inch metal or cardboard over a pencil, giving a clip that springs open. With these clips all paper, prints and blankets must be handled. Of course, the inky fingers must never get inside the clips. As far as possible, too, inking of the hotplate should be avoided, and the ink slab, tampon, rollers and pads of gauze must be kept free from grit. It is recommended that they should be stored in a box over the hotplate. Blankets are removed from the press as soon as the work is finished. Pressure should never be left on them. Then they are either washed or hung up to dry. Ink should be scraped from the saturated gauze after use and they, too, should be hung up to dry, not left in clotted knots.

In spite of all these precautions it sometimes happens that bad or imperfect prints are obtained. A competent printer must be able to identify the source of error.

A print may be wrinkled, puckered, shiny on the surface, or smeared. Lines may be spread or doubled. The wrinkling or folding is generally due to the condition of the paper before printing. A shiny surface on the print shows excessive pressure, which may also be a cause of smearing or spreading of the ink out of the lines. Spreading may, however, also be due to there being too much oil in the ink. Doubling, unless caused by a buckled plate moving or rocking on the bed, is due to unequal adjustment of the pressure screws on the press. Wet blankets or blankets stiff with size from damp paper will also cause wrinkling, polishing of the surface, and poor prints. The blankets always creep an inch or so as the press rolls, so that a blanket adhering to the paper will finally form a pleat.

The causes of poor lines, interrupted by white dots, are as follows: (*a*) careless inking of the plate, (*b*) the paper has been too dry or there has been grit on its surface, (*c*) the ink has been too dry, and (*d*) there has been insufficient pressure on the press: (*a*) can be identified by examining the plate after printing when ink cannot be seen in the lines that missed, (*b*) by the feel of the paper, (*c*) by the presence of ink still in the plate, and (*d*) by the fact that the ink still in the plate is apparently wet. Unless it is certain that the paper being used is suitable for intaglio printing, this also should be examined. Certain papers which are manufactured with resins, or hard size, in the pulp, the size being fused in the fiber by pressure and heat, are completely unsuitable for printing in intaglio. As the fiber refuses to absorb water, and as only damp fiber can take an impression, such papers will reject the ink. I can recall wasting days with a Japanese Super Nacré paper of commercial manufacture, which had been prepared in this way, although a similar looking paper had previously given excellent results.

Odd lines missing in an otherwise satisfactory print are generally due to bad inking or sometimes to grains of copper or other matter in the lines. With good ink it is very rare that, once in the line, it will be removed by the hand or the pad of gauze.

PAPERS

For printing from intaglio plates any paper can be used which can be completely damped, but the difference of quality in the print made

126

on wood-pulp paper and that on handmade pure rag paper is remarkable. Every paper requires slightly different treatment in damping and preparation, and also in the degree of pressure that is needed to obtain perfect prints. It is often more difficult to print well on good papers than on poorer ones.

Handmade rag papers

Up to the nineteenth century methods for the making of bad paper were unknown, consequently all papers of the seventeenth and eighteenth centuries are excellent. Though in some cases these were originally sized, that size has disappeared in the course of time. However, such paper is very rare in sheets of large dimensions. Modern rag paper is good or bad for a variety of reasons, these including the quality of the pulp, whether the rag was reduced with the stamp mill or the Hollander machine, the absence of chemical treatment or bleaching, and the skill of the hand that made it. English papers such as Whatman, F. J. Head, Chatham and Arnold are strong, long-fibered but often very heavily sized and sometimes very hard-surfaced from hot pressing. Such papers need long soaking under pressure to produce perfect prints. Any paper which is perfectly white has been bleached and will not remain white but will inevitably yellow in sunlight.

Dutch papers like Van Gelder Zonen are excellent, though I have an impression that the best paper was made 20 or 30 years ago.

The Italian papers I know are very poor, short-fibered, cutting easily in the printing and refusing to take a surface tone from the plate. This last can sometimes be remedied by resizing.

The finest paper I have used was Montval made by the late Gaspard Maillol in France, though many other French papers are also excellent. Some German papers, too, were very fine, though often bleached. A Spanish and a Swedish handmade paper we used were good.

American handmade papers, very few of which are now made, are good in texture but somewhat irregular, owing to the way they are made. A few sheets from the Lyme Rock mill in Connecticut, now unfortunately closed, were found to be first rate.

The Chinese papers, of the type of "India" paper, print excellently but are often loaded with kaolin. They are generally too fragile to be used without being mounted on strong backing sheets.

Handmade Japanese papers, particularly those made up to 20 years

127

ago, Hosho, Kochi and so on, which were generally made from the fiber of the paper mulberry, print very perfectly. They require special treatment as they often become extremely fragile when wetted, and it is wiser to damp them very slightly by interleaving them with damp blotters. At the moment of printing the sheet should lie flat, appear dry, but feel cold against the back of the hand. Less pressure in printing will be needed than is required on a laid rag paper. Prints on such paper need careful handling as the surface will wear and fray if badly rubbed.

All these papers are of two kinds, laid or wove, called *vergé* or *vélin* in France, according to the way the wires are placed in the tray or form in which the sheet is made. In the latter no definite lines can be seen through the sheet as the wires are woven together. In general, linear plates will present well on laid paper but aquatint or textures appear better on a wove sheet.

The machine-made papers can be used where there is no hard size present, but their usefulness depends entirely upon the quality of the fiber they contain. Form-made machine papers are often very similar to handmade, though more mechanical, as often the texture is obtained by passing the sheet through rollers after making. Wood-pulp paper prints excellently, its only disadvantage being that it is not durable. Papers loaded with kaolin, barium sulphate and other chemicals are unusable. Ruysdael, Murillo, Troya, and others are good domestic papers.

The weight of paper used for a particular plate should have some relation to the size of the plate as well as to the texture to be printed. Generally a large plate needs a greater weight of paper (perhaps 150 lbs. in the U. S., or 45 kilo in France). Also, aquatint will print more richly on heavy than on thin paper. To some extent, this can be overcome by backing thin sheets with blotters or other soft paper.

INK

The black inks used for printing are made from a number of different pigments, Frankfort black made from charred wine lees, lake black, French black (*noir bouju*), vine black, lamp black, and other carbon pigments. They are ground in linseed oil or burnt oil; in commercial

128

K. Schrag. Night Wind. 15"x11"

Fig. 51

inks, stand-oil and varnishes are often used, sometimes with driers or siccative.

The ink we generally use in Atelier 17 is ground from Frankfort black with one half to one third the amount of a dense pigment. When French black became rare we used a synthetic lake black, and later a very intense vine black. The powder is mixed dry, and the plate oil worked into it with a little raw linseed oil, until it will hold together. As grinding makes it more liquid, it is most important to keep the total amount of oil down to the minimum, or the result will be too liquid. The mixture is then ground by hand with a glass or granite muller on a glass slab, or by a cone grinder. Machine grinding does not produce so good a result as the heat generated by rapid grinding seems to affect the oil. The consistency of the ink required for the best results has to be determined by experiment: in general, it can be said to work if the ink will drop slowly off the palette knife without running in a thread. No grit should remain in the ink when grinding has been completed.

The use of varnishes, driers, boiled oil, or stand-oil in ink is undesirable, though they are used commercially to give gloss to the ink and to cause it to dry faster. The ink, prepared as described, is dry enough to allow for the handling of prints after 48 hours, although oxidation is not completed for up to two years. As the oil used is unbleached, at the end of this time the print takes on a warm color due to the microscopic margins of brownish oil around the blacks. This results in no loss of intensity. The practice of imitating this quality by mixing colors in the black ink is less successful as it weakens the intensity of the black. It should be noted that the ink we use, unlike some of the commercial preparations, dries to a mat surface.

CHAPTER

7

PRINTING II: COLOR PRINTING FROM INTAGLIO PLATES

The procedure for printing from engraved, etched, aquatint or dry-point plates in other single colors than black follows very closely upon that described in the last chapter. Inks in color, however, do not wipe as easily as black, and the proportion of oil used in their preparation has to be varied to get the best results. With iron oxide reds, or with ochre, for instance, it is necessary to reduce the percentage of heavy oil in the mix owing to the soapy quality of the pigment.

Certain differences arise in planning a plate for color which do not occur in planning for black. As the contrast between worked and unworked parts of the plate will be red and white, for example, instead of black and white, more violent working will be needed to give an effect of the same intensity. Although all the variations from black to gray to white (except for the slightly warmer or colder tone described in Chapter 2) will appear as the same hue, a red will appear almost black in heavy burin passages, then as deep red in strongly bitten textures, and as a series of pinks in light aquatint or in the tone left on the surface.

Thus the work will seem to be in a series of three different reds rather than in one color.

Printing several colors simultaneously from one plate (à la poupée)

This method is used in the production of the tinted horrors known to the trade as "bedroom etchings." A bitten and aquatinted plate, sometimes with dry point, is inked in different areas with "dollies" (*poupées*) of rolled canvas or felt, and is wiped, one area at a time, with gauze and the hand. A separate pad is, of course, kept for each color. The effect is a gradation of tints over the lines and the surface of the print. Roger Lacourière in Paris has used the method for printing from multiple plates with very fine effect.

Printing various colors successively from one plate in intaglio

A simple method which has given quite interesting results in the hands of Raoul Ubac, Mauricio Lasansky, Karl Schrag and others, consists of printing in one color from the plate, then removing the plate from the press, re-inking it in black or another color, entirely or in part, and reprinting on to the proof with a deliberate slight error in register. As an extension of his experiments in photography, Ubac printed a negative, surface-inked proof slightly out of register with a positive to get an illusion of surface in relief. Certain of Lasansky's dry points were printed in cold color over previous warm color, giving a peculiar stereoscopic effect. In his *Night Wind* (Fig. 51), Karl Schrag used successive intaglio impressions in green and black about 1/32 inch out of register to obtain a vibration and density in the represented space, like mist or turbid water, in keeping with the mood of the plate.

Another method which has been very little used is to place, over a plate inked in color, a stencil as a mask exposing only those parts of the design in which this color is needed. The plate can then be re-inked with a second color and reprinted with another mask exposing only those parts in which the second color is needed (Fig. 52). By this means a very clear definition of color elements can be obtained, in a way that is impossible by the *poupée* system. From textured, aquatinted or lightly worked passages in the plate overprinting in two or more colors is possible, particularly if the deliberate error of register is used to avoid fouling. It is clear that with all of these methods a very definite

131

plan of operations is necessary as well as experience of the consequences that can be expected from the association of the various colors.

Simultaneous printing from surface and intaglio

In this method, used by Atelier 17 since the late twenties, after the preparation and wiping of the intaglio plate in black or other color, a film of oil color is deposited on the more or less free surface of the plate, in areas defined sometimes by stencils, the fingertips, a roller or
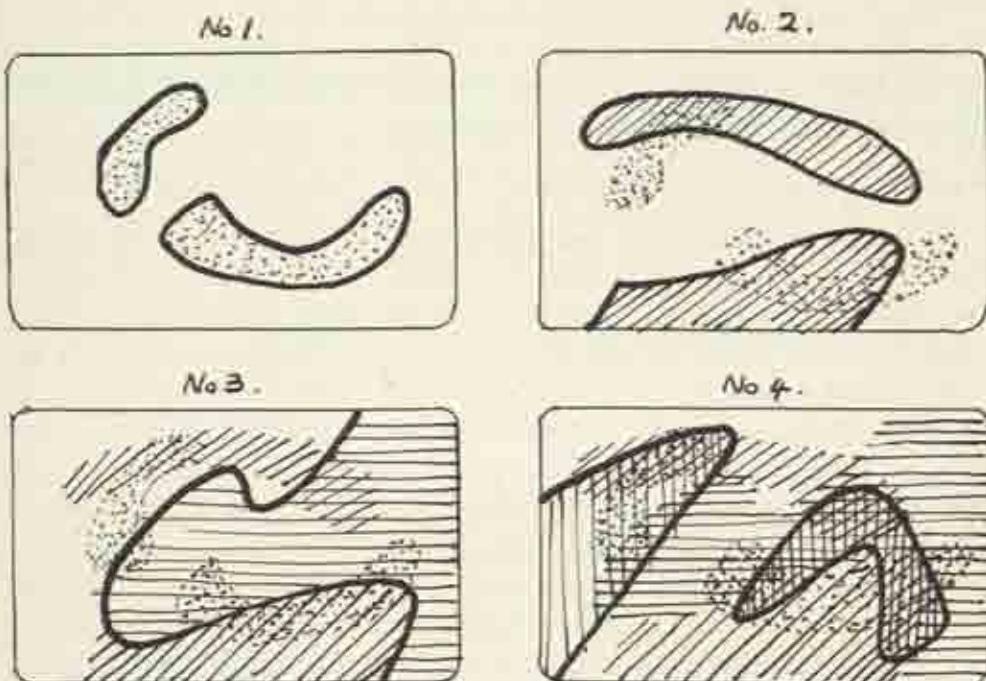
Fig. 52. Printing in Four Colors from a Single Plate through Stencils

other appropriate means. The whole combination of surface color and intaglio color is then transferred to damp paper exactly as described in the last chapter. Thus a single passage through the press is all that is required, problems of register applying only to the placing of the color elements on the plate surface.

Here several requirements of the medium will be apparent. Inks must be used and color deposited on the surface in such a way that it does not mix with the ink already in the plate. Then, as it is clear that an opaque oily ink between intaglio ink and damp paper would

132

prevent its adhering to the print, the film of color on the surface must remain so thin that it is microscopically porous. Also, it is seldom possible to superimpose two colors, both because of fouling and the risk of developing too heavy an ink layer, so practicable transparency will be confined to a bitten texture in intaglio over a single surface color in each part. Of course, the surface color being above the intaglio in the plate will appear underneath it in the print. I consider that certain of the Hercules Seghers prints, generally described as hand-colored, were in fact printed in this manner. My own *Centauresse* (Fig. 53) plate was printed in this way, using four surface colors through stencils and intaglio red-violet. A further development of this single plate technique for as many as five colors, which was developed in 1945, is described in Chapter 10.

Printing from several intaglio plates in color

This method of obtaining an image in color has been applied to the reproduction of works by many modern painters, particularly by Jacques Villon and Roger Lacourière in France. Prints are numbered and signed by the painter and often the buyer does not recognize that they are not, in fact, the work of his hand. Printing follows the same procedure as described but various methods are used to ensure exact register of the plates. As all intaglio printing is carried out on damp paper, and as all good papers stretch when damp, it is necessary to control the humidity of the paper so that the sheet will be of the same size at each printing. If register is taken from near the center of the sheet, the variation will be at a minimum, but, by control from the margin, the possible amount of error is increased.

If the maximum intensity of color is sought, or if a large printing is planned, it will be necessary to allow each color to dry before printing the next. Thus the paper will need to be rewetted. Many French printers employ a heavy wood-pulp paper which requires little humidity and hardly varies in size, wet or dry, to avoid this difficulty. A Japanese Kochi paper that needs only to be placed between damp blotters to prepare it has been used in Atelier 17.

Methods of register

There are three general methods of register in use:

(*a*) In France it is usual to assemble all plates of the same size in which the image is in register, usually ensured by printing back on to these subsequent plates from a wet proof of the key plate, and to drill two small holes through all of them in positions which will not be too

Fig. 53. S. W. Hayter: Centauresse, 1944. Six-Color Engraving

A

FELTS

NEEDLES

DAMP PAPER

PLATE

B

FELTS

STOPS FOR PAPER

METAL MAT

PLATE

C

PRINT 1ST COLOR

FELTS

PLATE 2ND COLOR
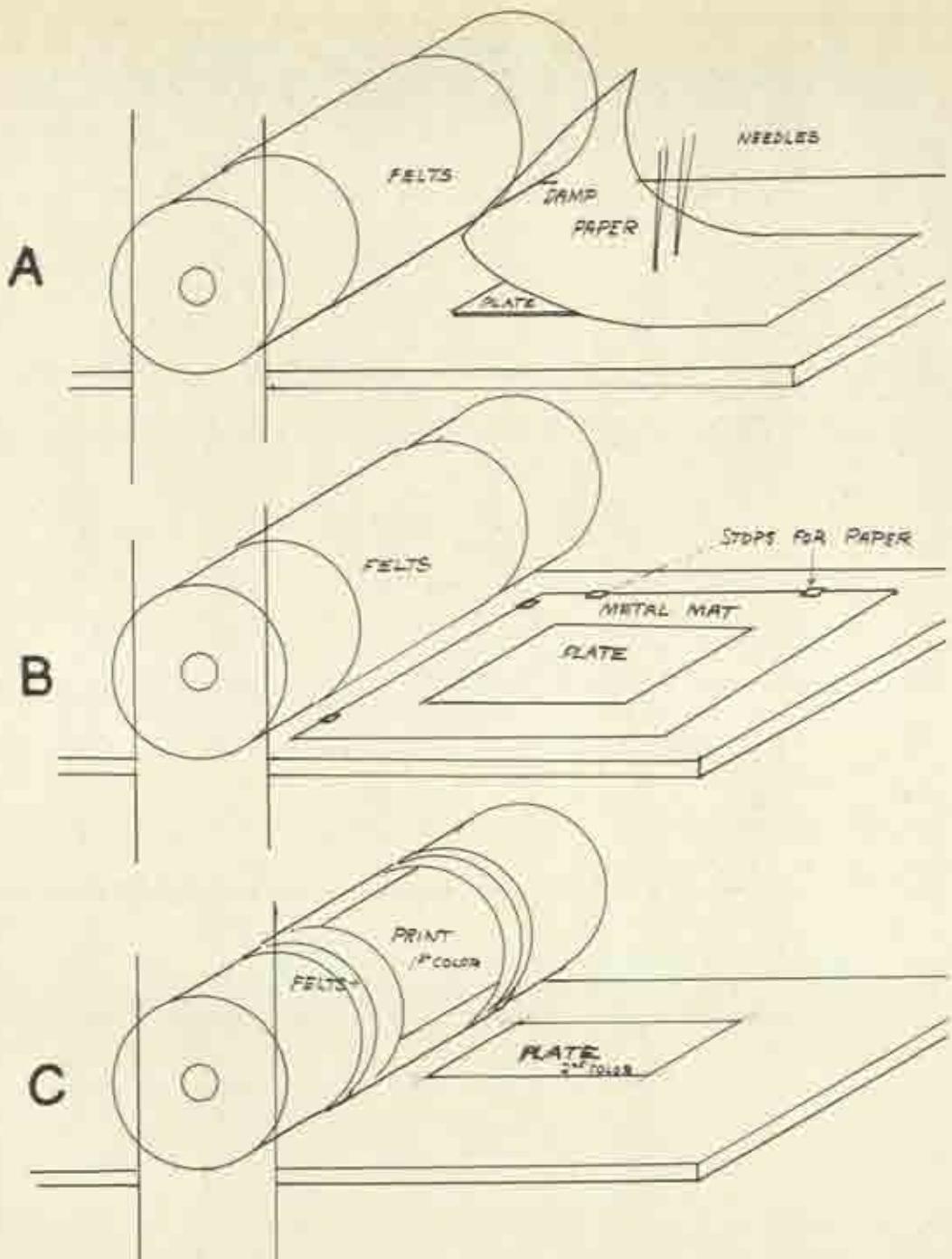
Fig. 54. Three Methods of Registration

conspicuous on the proof. All the sheets of paper to be used are then pricked through with a needle passed through the holes in one of the plates. When the plate is ready on the bed of the press the sheet is placed by engaging two needles passed through it with the holes in the plate (Fig. 54A).

(b) The method used by Fred Becker (Fig. 55) in the Atelier for surface or intaglio printing makes use of a metal mat, having an opening cut to fit the plates, carrying three stops, made by turning up tabs of metal, which are outside the travel of the blankets. The sheets fit against these stops and consequently fall in the same position. Where the printing is done wet on wet, that is without allowing the ink from one printing to dry, and without loss of time in replacing the plates, the method is almost accurate. However, as register is from the margins of the sheet, it is not proof against the varying humidity of the paper (Fig. 54B).

(c) For making trials from color plates we have also used another system. The position of the plate is marked accurately on the bed of the press. A sheet of paper is cut to allow long margins at both ends and, after the first printing, the sheet is held by one end in the press and turned back over the blankets and roller. If the second plate to be printed has not already been prepared, a damp blotter may be laid over the print to prevent drying. The second plate is then placed very exactly in the marked position on the bed, proof and blankets are laid down upon it again and the press is turned until the second impression has been made. The sheet still remains pinched in the press by its other end. The process may be repeated as many times as necessary. If done carefully it is accurate to within 1/32 inch even on large plates, but it is only applicable when printing wet on wet (Fig. 54C).

(d) A method employed by Mauricio Lasansky for printing in two colors from the same or different plates involves printing the first color normally as described. The second plate is then inked and prepared. The proof, which has been kept damp by covering it with a damp blotter, is laid face up on one blanket on the bed of the press. The second plate can then easily be placed on it, the back of the plate being covered with paper to protect the blankets which are then laid on top. The plate is then printed upside down. The method has the disadvantage of giving a rather poor second printing as there is only a single blanket against the proof instead of the usual three or four, and there

136

F. Becker. The Cage. 7"x5"

Fig. 55
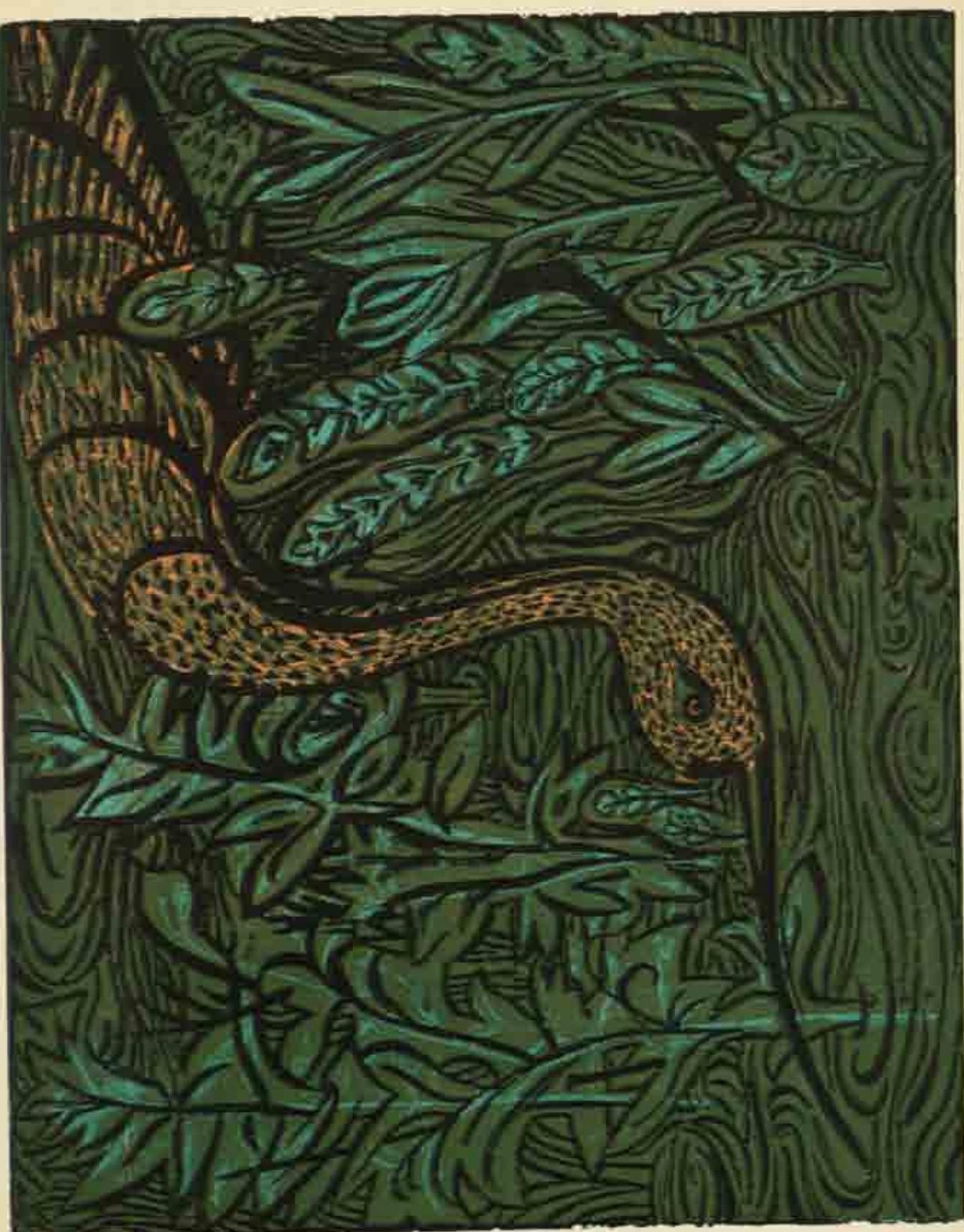
is also some inevitable buckling of the second plate under the pressure of the upper roller as the undermost blanket compresses.

In planning and making a series of plates to be printed in color the artist needs to be familiar with the many technical and theoretical requirements of the medium. Zinc plates, unless they have been plated, are undesirable for the printing of pale colors as they give a slight surface gray. Certain colors, as vermilion, cannot be printed from copper as they react with the metal. Strong cutting with the burin is undesirable in a color plate unless it is the last plate to be printed, as subsequent printings would flatten the relief of the thread of ink on the sheet and, if printed wet on wet, the line would spread. The work done on the plates must be clearly planned with regard to the opacity or transparency of the result. As in the printing of surface color, if too solid a layer of ink has accumulated in one place on the proof, subsequent impressions will fail at these points. Jacques Villon has developed a method of printing in transparent color, even with opaque pigments, by carrying each color in a system of parallel lines, etched, dry point or burin, so that no one line of color will fall on another and white paper will come through the design even in the strongest passages. Roger Lacourière prints reproduction etchings with some dry point and aquatint or mezzotint, inking each plate *à la poupée*, so that even when using ten colors only four actual printings are necessary. From experience of the commercial methods of printing it has been found that the greatest transparency and brilliance of color is obtained by offset (color printed from the source on to an intermediate surface and from that on to the sheet); less brilliance comes from surface printing, and no intaglio color is quite as transparent or as intense in light reflection as either of these.

In the use of colors in printing, as in painting, it is to be noted that there are two possible consequences of employing the same pair of colors. Thus if a red-violet line or point is placed near a blue-green line or point, leaving between them about the same space as their thickness, in the white interval a yellow will be seen. This color effect, called subtractive, is that sought by the impressionists in their use of divided color. But if the two colors are superimposed a blue will appear, the effect being known as additive (see Fig. 63, top center). Apart from their transparency, all colors from surface or offset will be of the same hue, while color from intaglio printing will appear, as already described, as if composed of several distinct hues of the color.

CHAPTER

8

**PRINTING III: PRINTING ON FABRICS -
MACHINE PRINTING - PARCHMENT, HIDE,
LEATHER - RELIEF PRINTING - CLASSIFI-
CATION, NUMBERING AND PUBLISHING OF
PRINTS - RECORDS**

Printing on fabrics

In the sixteenth-century patterned fabrics of linen, cotton and silk were printed from intaglio plates, for instance by Hercules Seghers (Fig. 57), and some of the early engravers made actual prints as images on woven materials.

Hand-printing in colors on textiles was revived in recent years by Atelier 17, working from etched and engraved plates. Fine linen was found to give a very accurate proof, and silk was excellent where the weave was close enough to take a fine impression; cotton and rayon were definitely less successful.

As in practice these fabrics may need to be cleaned, the inks or colors used should be planned to resist solvents. The inks used for fine printmaking dry very slowly and if used on fabrics would only resist cleaning after about a year. The ink for fabric printing is therefore pre-

pared as described for intaglio printing but the raw linseed oil in the mix is replaced by Haarlem (Cobalt Linoleate) or other siccative. As this ink will dry and form skin rapidly on the slab it is advisable to take a very heavy ink containing only heavy oil and pigment and mix a small quantity at a time with the siccative to the consistency needed for printing, sufficient for one or two prints at a time.

In handling silks or other fabrics for printing the chief difficulty arises from the elasticity of the material, particularly if wetted. Hence we have found that using the material dry and laying it on the press so that it is stretched across the plate with uniform tension and covered with a damp sheet of paper, was more convenient than wetting the fabric itself before printing. Colors applied to the surface of the plate with roller or dabber over intaglio inking can be printed quite easily if the thickness of the color film is kept at a minimum (as with printing on paper). This is the only practicable manner of using multiple color on fabric, as register by hand-printing is extremely tedious and uncertain. Frequently for decorative purposes the impression should not show a rectangular plate mark. In this case, unless the plate is sawn out to the profile needed, a cut-out mask can be laid over the plate which then prints only the form exposed.

Printing on fabrics by machine from engraved plates

The Atelier has been experimenting on the possibilities of making rollers for intaglio (solid-deposit) printing on fabrics in large quantities. The roller of copper, or copper on steel, is made sometimes by depositing the copper surface electrolytically, sometimes by shrinking a copper sleeve on to a steel core (somewhat as rotogravure cylinders are made, but the depth of engraving is much greater in the fabric rollers). As these rollers run in wells of liquid ink and are stripped by a ductor blade they have to be perfectly concentric and parallel to within 1/1000 inch; therefore wide hollows of relief whites as used in the flat plates are not practicable. The methods used at present to make such rollers are photogravure, in which a screen is used to break solid tones into dots, and machine engraving by a sort of pantograph. The circumference of the roller determines the interval of repeat in the design, and its length the width of the material. Both of the methods used would fail to give all the detail of the hand-engraved plates; the screen would interfere with textures and bitings, and the traced mechanical
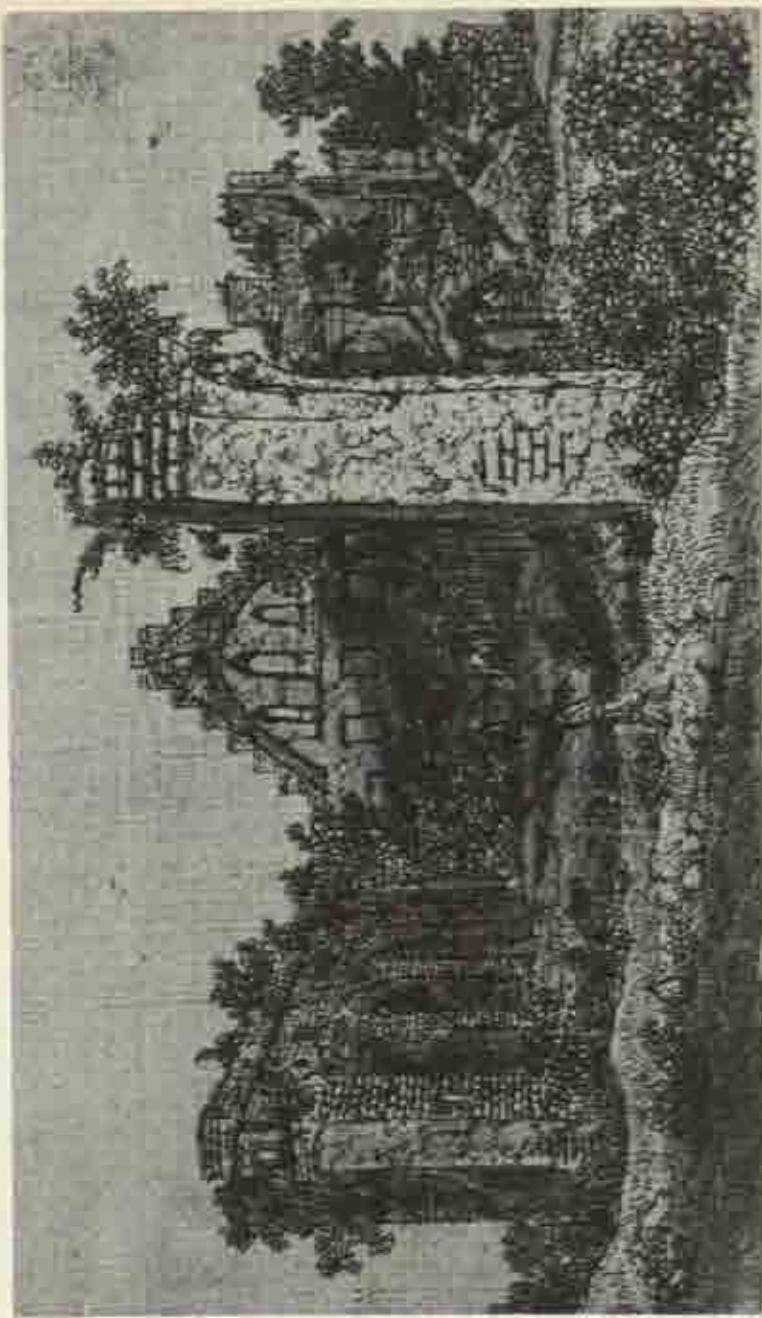
Fig. 57. Hercules Seghers (1590–1640/5): The Small Church Ruin.
Color Print on Linen

quality of the pantograph would not reproduce the flexibility of the trace of the burin.

Experiments are being made at present on the possibility of making a matrix from the required number of repetitions of hand-engraved plates, forming it into a hollow cylinder, and then depositing an electrotype sleeve of copper inside it which could finally be machined internally to be shrunk on to a steel core. The difficulties of the process have to do with the extreme accuracy of the final dimensions of the roller. If successful this method would provide a microscopically accurate replica of the original hand-engraved and etched plate, with the necessary repeats for machine printing. (Of course, unless printed with the greatest possible precision, this quality will not be apparent in the final product; but perhaps the consumer is not yet trained to distinguish such qualities.)

Printing from intaglio plates on parchment, hide, leather, etc.

It is practicable to print from etched and engraved plates in intaglio on to any resilient material which will absorb water. Prints have been made on parchment (sheepskin) and on various kinds of rawhide and leather.

The parchment to be printed should be as even in thickness and texture as possible and not only perfectly free from grease but also from whiting, talcum (French chalk), or other dressing, often used to prepare vellum to give it a whiter or more regular surface. If such materials are present the surface may be sponged with clean water containing a few drops of ammonia and the skin immediately stretched on a board either by gummed paper around the edges or, better, with pins at intervals of about ¼ inch. Unless this is done whenever such material is dampened it will contract and deform very violently in drying. Unless such treatment is necessary it is advisable to dampen the vellum as little as possible; in practice I have found it sufficient to press the material between slightly damp blotters for twenty-four hours. Inks for printing on such material should contain less raw linseed oil than those used for printing on paper as there is less absorption; and rather more pressure on the press should be used. If an imperfect proof has been made it can be cleaned off completely with petroleum ether, benzene or other light solvent; the skin is then sponged with ammonia to remove traces of oil and restretched in readiness for another printing.
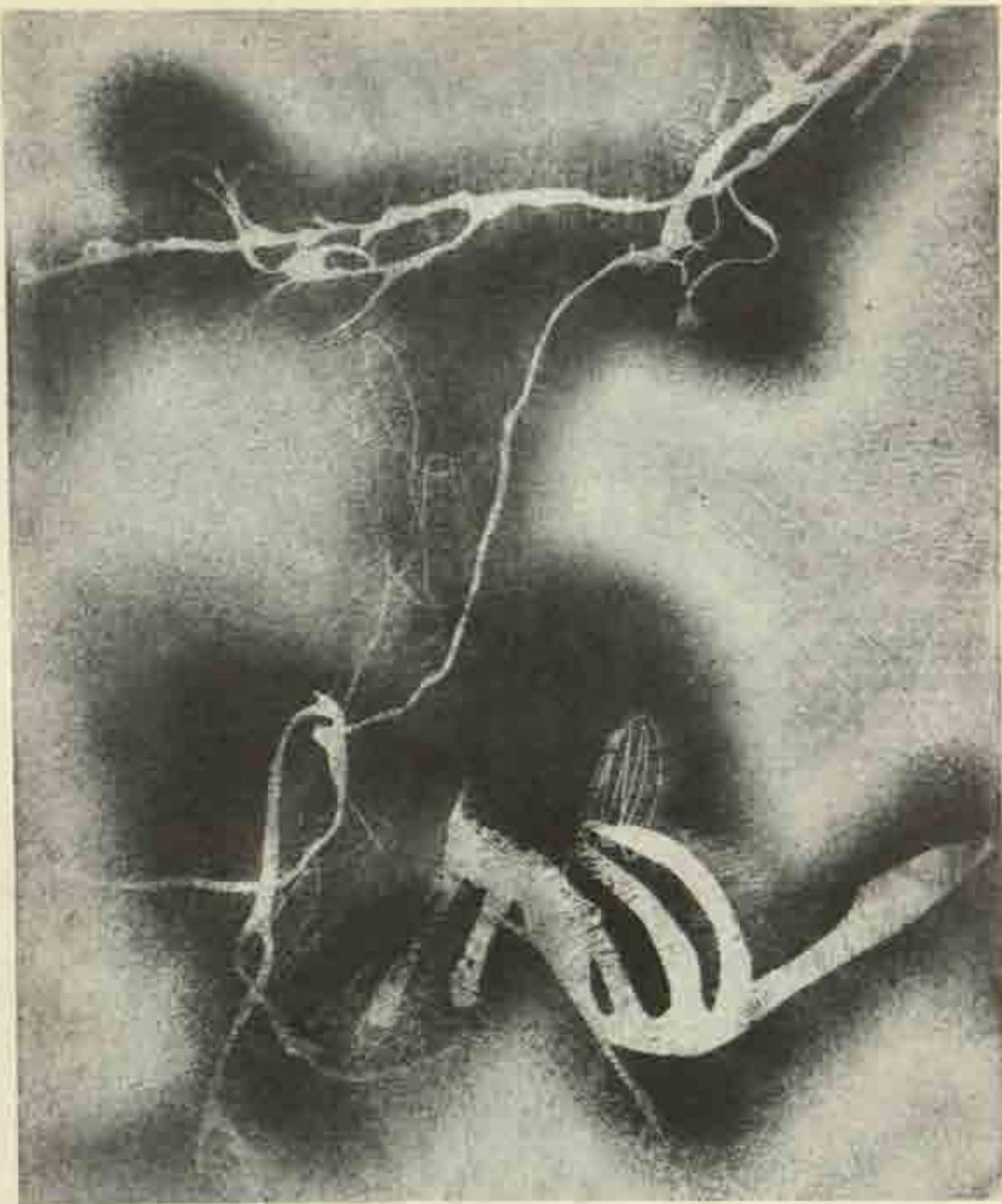
Fig. 58. Primer: Composition, 1935. Relief Print

Hides, leather, and other animal materials are treated in much the same fashion: generally if very soft they require little or no dampening, but if hard they must be softened with water to mold into the crevices of the plate.

Relief printing from engraved and etched plates

It is obvious that plates made by any of the methods described except by dry point or mezzotint can be printed in relief by depositing the ink upon the surface without filling lines or holes (Fig. 33B). The contact presses used for typography or a screw book-press would provide sufficient pressure, which is less than that used in intaglio printing. Where the work is to be printed with type on a conventional press the plate would have to be mounted on a wood block type-high. Plates worked for this purpose should be engraved and bitten far more boldly than those worked for intaglio printing, for some of the finer lines and textures used in etching cannot be kept clear of ink in mechanical surface printing. There is sometimes strong objection on the part of printers to print from such plates, though I think that the quantity of such plates that may be used in the future is unlikely to affect seriously the photoengravers' monopoly.

Although the roller press is not intended for surface printing, with a little modification it can be used to make prints from such plates. The plate is inked with a gelatine roller coated with typographic ink (not the ink used for intaglio printing) which has been rolled out on a glass slab until it shows a texture which will be found by experiment to give solid color and keep the hollows of the plate clear. It may then be set up on the bed of the press in a mat of about the same thickness as the plate, a dry sheet of smooth-surfaced paper placed on it. Then as the elasticity of the blankets is undesirable, a sheet of thin metal or red fiber can be used instead, above which one blanket is laid to counteract possible irregularities in pressure. The press is set to less pressure than would be used for intaglio printing.

The plates made for relief printing in the Blake manner described in Chapter 4 were printed in a slightly different fashion (Figs. 33A, B). From the small fragment of William Blake's plate of the "America" poem in the collection of Mr. Lessing Rosenwald in the Library of Congress and from the study of other prints of the same artist I had been convinced that the relief of type and image was insufficient

143

for inking even with hard rollers. With the poet Ruthven Todd, I studied the surface of the prints in comparison with the color-printed drawings in which the color is known to have been transferred from the surface of boards coated with paint. As under a glass both showed a similar reticulated surface we assumed that the inking of the plates had been also done by previously inking another plate or board, pressing this against the plate, separating the two surfaces and printing from the relief plate. The variation of hue from top to bottom in many of Blake's own proofs would be very simple to obtain in this manner. During the summer of 1947 with Joan Miró and others a number of plates were made and printed by this method in black and gradations of color. Some prints were also made in which the background was printed in intaglio, then color from a second blank plate transferred to the surface and printed at the same time. The method has been used by Friedl, Calapai, and Peterdi in the Atelier.

Classification, numbering and publishing of prints

The European practice of numbering all prints in a limited edition so that each proof bears a figure representing the order in which it was taken from the plate, and as quotient the total number of prints in the edition is in general use in the Atelier. As prints are sold today (though I would not suggest that this is the ideal way of circulating ideas) the value of the individual print depends to some extent on its rarity, (though only if one assumes the existence of a demand). Thus there is no reason why if this has to be done it should not be done accurately, until the time comes when we may be able to circulate prints at very low cost in enormous editions.

The progressive working prints taken at different stages in making the plate are marked 1st, 2nd, 3rd, etc., state (*épreuve d'état*); if more than one proof of a state is taken it is also numbered, and it has been my own practice to date these proofs as the information may be needed later. When the final state is reached, it is usual to take a few trial or artist's proofs (*épreuves d'artiste* in the French sense; in England and U. S. all prints made by the artist are often called artist's proofs), and convention in France limits them to five—generally numbered in Roman figures or lettered A, B, C, D, E to distinguish them from the definitive edition. Frequently they are made on different papers or with different inks to find the best conditions for printing the final edition. It has been the custom for the artist to retain these prints and the states, or one set of the states, even when the whole edition is sold to a

publisher. The normal commission for sale of prints by galleries is 33⅓%; where an edition with exclusive right of sale is sold outright the price paid may vary between ⅓ and ½ of the face value of the proofs, depending on apparent ease of disposal and the dealer's intention of selling either directly or through intermediaries. Where series of plates are made with a text, arrangements with a publisher will take into account his expense in paper and printing, advertising and making boxes or binding, etc. In these cases two extra copies 0 and 00 are made for legal deposit (Bibliothèque Nationale, in France—Library of Congress in U. S.). In England it is necessary to provide five copies for copyright purposes. Generally a number of copies marked *Hors Commerce* in France and not offered for sale are made for the collaborators, as specimens, for presentation and advertising.

Records

Whether the artist publishes his own prints or whether a dealer handles them, a record should be kept showing dimensions of plate, description of technique, dates of commencement and termination, paper used and dates of printing. Every print made should be recorded and it is useful to add notes of destination of prints sold, exhibitions in which shown, prizes, etc. At one time I used to keep records of plates on failed proofs of the plate, but it is much wiser to keep all such records together in a book. Of course no further prints are taken when the edition is completed, though it is sometimes well to keep the plate so that a print which has been physically destroyed could be replaced. Ultimately the plate is cancelled or destroyed. Recently I have cancelled plates by engraving a signature recto across a worked passage, impossible to remove without trace; thus if prints are ever made again from the plate they could not be offered as the original edition. This method preserves the plate as a work of art, and as many museums (The National Gallery, The Chicago Institute of Art, The St. Louis Museum, The Brooklyn Museum, The Museum of Modern Art) have bought such plates, often more beautiful objects than the prints, I do not see why they should be actually destroyed, since the owners of the prints are adequately protected.

CHAPTER

9

PLASTER, CARVING

The first printers in history, or, rather, before the beginnings of history, were the men who found that a tool or a mold could be pressed into wet clay, leaving an impression or a cast. The Sumerians of 3000 B.C., had a fully developed technic of writing on clay with two simple arrow-shaped tools, one long and the other short, making "cuneiform" impressions which were assembled in groups as words. The same ingenious people made hollowed-out marks on cylinders to be rolled on the clay (Fig. 65), which were developed from simpler seals merely pressed into it. The hollowing-out was, of course, "intaglio" as we understand the expression since its first use in the sixteenth century. When an engraving is printed on a roller press with damp paper backed by the resilient woolen blankets, a cast is made of the surface of the plate, in exactly the same way that the clay was molded by the carved surface of the Sumerian cylinder seal. Very early in the Western development of printing, perhaps even at its very origin, casts were made, in clay, in wax and in molten sulphur, from plates which were being engraved. The reversal of inscriptions and details shows that, often, such casts were made from plates which were not intended to be printed at all, but which were designed for purely decorative purposes.

In *A Treatise on Etching* by Maxime François Antoine Lalanne (1827–1886), translated from the second French edition by S. R. Koehler and published by Estes & Lauriat in Boston, Mass., 1880, a method is described of making a print in plaster of Paris. Since about 1931, in Atelier 17, we have developed this method. It has the advantage of showing the relief of the lines even more clearly than a print on paper, and it also provides a means of making a print without a press.

TO MAKE A PRINT ON PLASTER

The plate, which may be engraved, etched by any of the methods described, dry point or mezzotint, is inked as for printing on paper.

The ink used should contain rather more oil than that used for printing on paper. When printing on paper a too liquid ink cannot be used as the pressure causes it to spread around the lines. With plaster-printing there is practically no pressure, and, as the oil is absorbed by the setting plaster, enough oil is needed so that, after setting, the thread of ink will not be dry enough to crumble nor to adhere to the plate when it is lifted.

When the plate is wiped, in the manner described, with gauze and/or hand, it is important that a film of oily ink should remain to isolate the plate from the plaster, so it is unwise to make use of whiting in cleaning the hand. If the plate is kept fairly warm on the hotplate during cleaning it will, as a rule, retain this essential film.

The plate is then laid face upward on a glass or other clean smooth surface, placed so that the margin is regular, and a frame, at least ¾ inch deep and large enough to leave a margin of an inch or two around the plate, is placed in position. It is advisable to place weights on the corners of the frame so that it will not float off when the plaster is poured. The plate must be allowed to cool before casting.

Plaster of Paris, plaster cement, hydrocal, etc., is mixed as for ordinary casting, enough being prepared to make a ½ to 1 inch thickness, according to the size of the plate. The usual method of mixing is to sift dry plaster into cold water until it no longer sinks, allow it to stand for a moment and then stir it thoroughly and allow it to stand again. Some plaster workers tap the bottom of the pan to cause any bubbles to rise to the surface; water that separates is poured off. When the plaster has the consistency of heavy cream and begins to feel slightly warm, it is ready for pouring. We generally pour from one corner, allowing the

plaster to creep slowly across the surface so that no air bubbles are trapped in the hollows of the plate (Fig. 59). When the plate is covered, pieces of jute fiber, soaked in plaster, may be laid across in all directions to reinforce the block.

In setting, the plaster heats up, and the plate must not be lifted until the block has become completely cold.

The block is then taken and, with the plate still held firmly against the cast, is slid off the base and turned over. If, owing to any irregularity of the plate or the base, the plaster has covered the edges of the plate, these unwanted excrescences must be cut away cleanly with a knife.
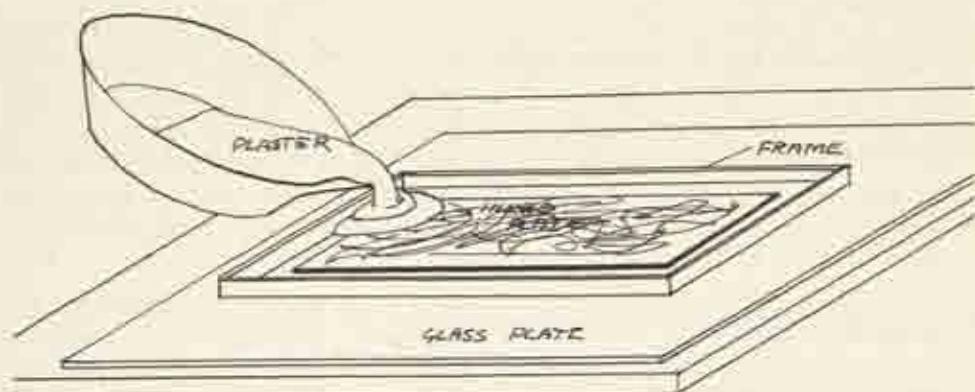
Fig. 59. Printing on Plaster

With a large or strongly worked plate it has been found advisable to heat the plate, by placing a warm object such as a flatiron or a can of hot water on it before lifting it. Lifting a plate is also made easier by inserting a point or a knife blade under one corner.

The print should have a surface as smooth as polished marble over the unworked plate surface, the lines should be black, and the even surface color left by the hand or gauze in wiping should be seen.

Sources of error in plaster printing

If all the lines are gray and broken it is probable that the ink contained an insufficiency of oil. If part of the print is gray, that is generally due to badly mixed plaster; water, which should have been taken from the top of the plaster, will, if allowed to run on to the plate, cause this grayness. Bubbles in the plaster are also due to careless mixing or

148

pouring. Lines in the impression which have been broken away are generally due to carelessness in lifting, though, in a big plate which has been heated, the contraction of the plate in cooling can result in such breaks. Overheating before lifting may have the same effect through the expansion of the metal if the plate is large enough. It is definitely much harder to cast from a big plate than from a small one.

CARVING PLASTER PRINTS

Whether the plate has been inked or uninked, the plaster cast is actually a linear relief with a maximum projection of perhaps 1/50 inch. By carving, the space may be organized into a bolder relief.

The plaster block with the print on it will remain damp and soft for a week or two after it is made, and will then dry and harden. It takes about the same time for hydrocal and the other plaster cements to dry, but they become much harder than plaster of Paris.

In Atelier 17 we have often made plaster prints from plates in early states when only the bigger structures are present, and have combined the development of the theme by carving in actual relief. This has one definite advantage. The volumes to be worked are still large in scale. The scale of engraving and etching, when translated into carving, tends to become extremely minute and tedious. The resultant carved relief block may give most valuable indications of a direction in which the original motif may be developed into the plate for normal printing on paper.

The fresh block is easy to cut, but it is difficult to realize extreme accuracy, so it is most convenient to cut away large masses in the fresh block but, where working to a line, to leave about 1/16 inch to be shaved away when the drying out has finished.

A fine, pointed knife of the sort used in woodcutting, a small surgical knife, large and small round gouges, and small flat chisels are the most generally useful tools, though scrapers, drills and toothed tools may be employed.

In cutting to a line it will be found that a vertical cut crumbles the plaster on both sides; at an angle, only the undercut side will crumble, so it is wise to start a cut near, but not on, a line which is to be left and then shave gently down towards the margin.

The forms used will normally be flat, convex or concave. As all carving will be below the original surface of the block, a convex form will be
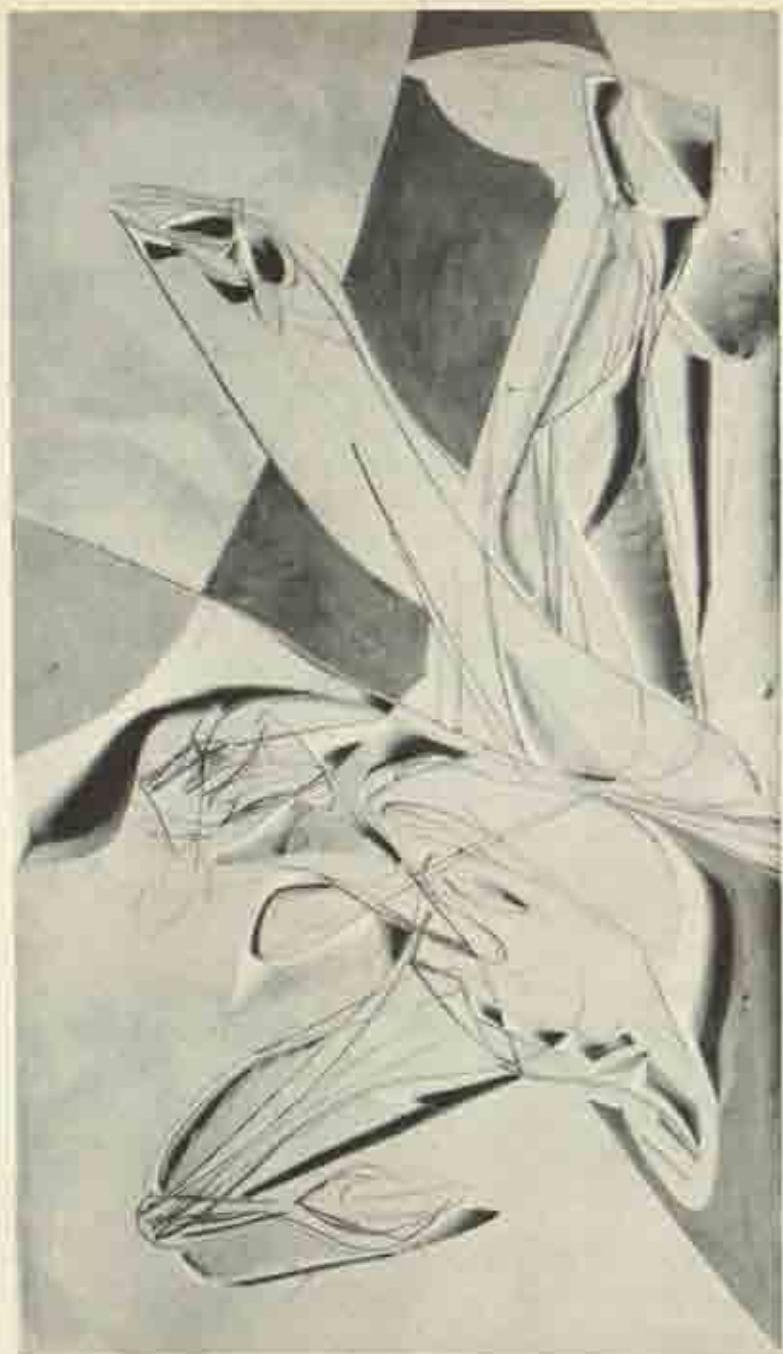
Fig. 60. S. W. Hayter: Laocoon, 1943. Carved Plaster Print with Color.

Fig. 61. John Ferren: Composition, 1937. Carved and Colored Plaster.
Print from Engraved Plate
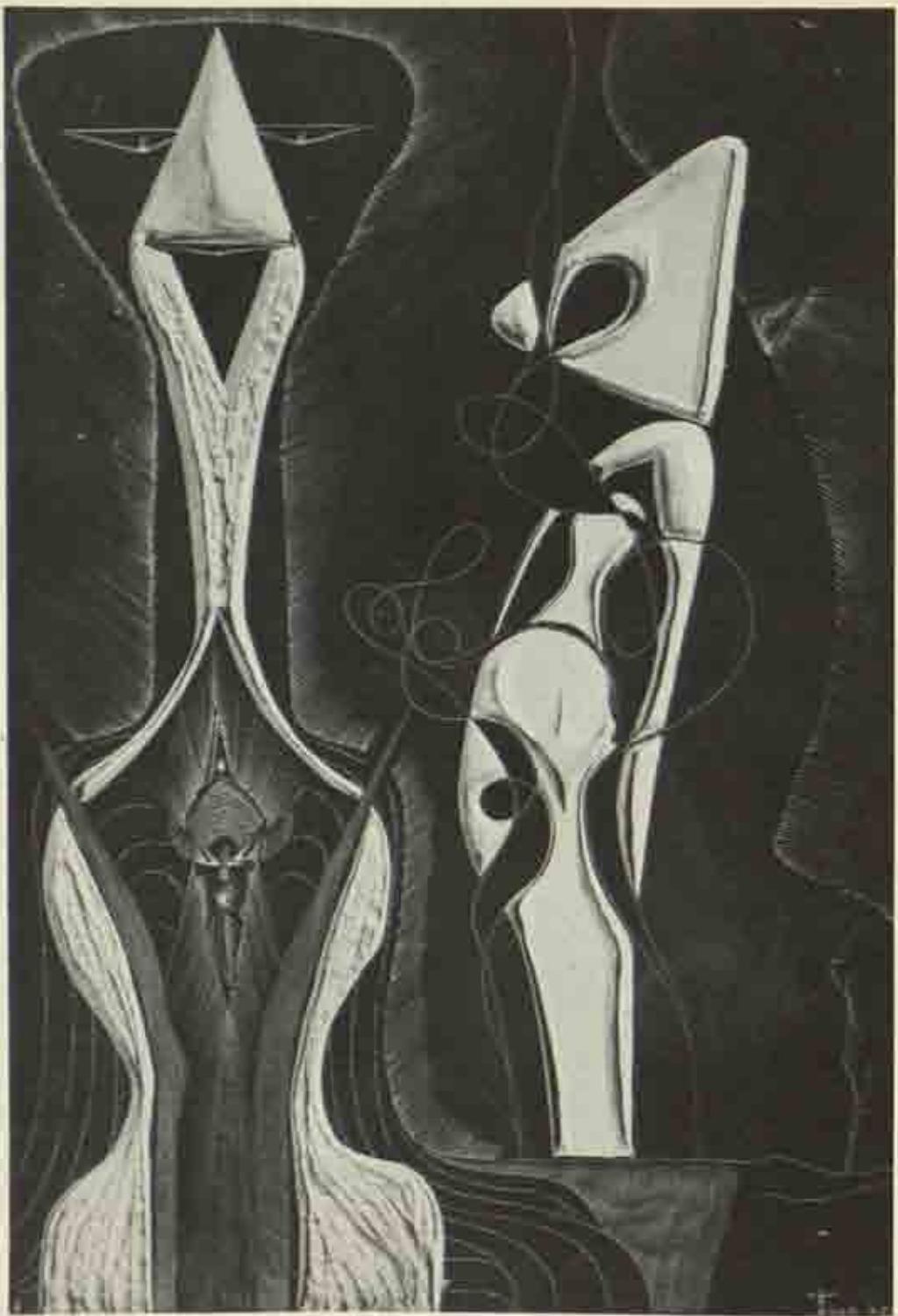
Fig. 62. Ian Hugo: The Rage of the Prophet, 1945. Carved Relief Print
on Plaster from Engraved Plate

within, or partly within, an incised outline. The effect of a concave form in an incised outline is most interesting (see Chapter 16).

Owing to the scale of the engraved print, even if much of the small detail has been cut away, enough will remain to impose a small scale on the whole relief. It is essential to finish the carving with great precision. Surfaces may be worked with tools made by gluing fine sandpaper to sticks and pointed tools, and the most useful finishing material is ordinary wrapping paper which is sufficiently abrasive to polish the surfaces.

Ways to work

Consider the block, illuminated from above diagonally, and then carve the surfaces to show light, shadow, recession, volume, or hollow in relation to this light. A plane turned towards light appears to come forward, turned against it, to recede. The consistent practice of this method is, as a rule, dull.

The actual volumes may be considered: a round where volume is required, or a hollow, or a slope-back where a recession is wanted, cut forward from the incised line where the projection would be needed. The results of this system are also rather dull.

In fact, the only counsel one can offer an artist investigating the medium is to try it, following a more or less instinctive organization, and see what happens. Examples of work in the medium are Hayter's *Laocoon* (Fig. 60), and Ferren's *Composition* (Fig. 61).

Color may be applied to the reliefs after carving. A curious effect is given by incised volumes of color, the original uncarved surface being left uncolored, for the systems of colored volumes organize themselves in a more or less complete composition seen through the plane of the remaining surface elements. Either tempera color, with an egg or casein base, or oil color can be used, but only those pigments which can be used on lime in fresco painting are safe on plaster, and oil pigments may show margins where the oil has penetrated the plaster. Printing on plaster may also be done from a surface-inked plate, as in an example by Ian Hugo (Fig. 62), where the unworked surface of the plate appears in black or in color.

Plasters have been printed even by such complicated methods as the intaglio and three-color offset described in Chapter 7.

From the practice of carving relief prints we were led to experiment with clay pressings. For these we used pottery clays, such as terra

cotta, which could subsequently be fired. An ink was prepared by grinding potter's underglaze black with the burnt oil used in making ordinary printing ink, and the pressing on damp clay, made from a plate inked with this compound, was fired. The result, which so far we have only been able to realize on a small scale owing to the special equipment needed for handling clay, was a ceramic proof of great permanence, having the intensity and surface relief of a print on plaster. There is no reason why such tiles should not be glazed or carved before firing, when an extremely durable relief would be made.

CHAPTER

10

"CINQ PERSONNAGES": DESCRIPTION OF EXECUTION FROM DRAWING TO FINAL PRINT

For a description of the inception and development of a particular work to make some sense to a reader, it is necessary for him to be able to connect it up with a direction, a method perhaps, in any case with its place in a complete series of works by the artist. Some sort of confession of faith is also involved. To describe an act without its motive will limit its value to those who are already familiar with the subject.

Although, for personal reasons, I am no longer an active member of the Surrealist Group, the source of the material in all my works is unconscious or automatic. That is to say, an image is made without deliberate intention or direction. The impulse to make an image is definite, but no particular image is sought consciously. This may give the impression of a completely formless and unplanned method. However, as the following pages show, the execution of a project in a very indirect method, a method of making a print in color, not, so far as I know,

155

previously attempted, involves a great deal of forethought. In practice, the use of color and the organization of the space were found to have much in common with those already experienced in earlier work.

I will try to explain this apparent contradiction. In the first project, a drawing perhaps, no conscious selection of form is exercised, although, as with a print, the proportions of the plate selected and the sort of color to be used had been present in a nebulous state in my mind for a year or more. The hand which made the first study was, however, trained by twenty years of practice in line-engraving, the mind had assimilated all the mechanical processes involved in making the work until they became "instinctive," and the areas of the imagination which are provoked by the use of such means had been exercised for years.

Thus, if the source of material for such a work is irrational, its development and execution has to be strictly logical, not with the mechanical logic of imitation, but in accordance with a sort of system of consequences, having its own logic. At the different stages of development of the work, a choice is exercised, but with extreme precaution against the application of a pedestrian common sense when the inspiration flags. As Paul Klee says, "to continue *merely* automatically is as much a sin against the creative spirit as to start work without true inspiration."

The plate *Cinq Personnages* (Fig. 63) was commenced at the end of December 1945. From the start I planned to employ six components, all of which had, in some form, been used previously. These were (1) burin line, (2) bitten transparent textures, both to be printed in black, and three colors, (3) one opaque, orange, and two transparent, (4) red-violet and (5) green, with (6) relief white which would pass through all five elements. In the manner planned the composition would not be complete until all six components were present.

The first drawing, on a white sheet full size right to left as in a *print*, not left to right, mirror image, as in a plate, was drawn with pencil and red chalk to represent color and texture, and contained only the structure of the design. The loop-shaped interval on the left, the position of the head of the standing figure on the extreme left, the flow of space in the left panel, and the interruption by cross structure on the right and the position of the plunging figure were complete at this point. A small plate of the elements of the latter figure was made

at this time, December 1945. There were only a few geometric indications of the recumbent figure at the lower right, and the figure itself was not shown.

The main plan from this drawing was redrawn in reverse on the back of the sheet with some variations, showing it as it would appear on the plate. Two detail drawings were made of the spinning figure in the loop. One showed the skeleton of the consequent figure and the other the main organization of the first figure, which was not complete at this point. The figures were only complete when they were engraved on the plate, much later. The subsequent figure itself was not shown. The tracing of the main framework of the composition was made on the plate, using white transfer paper, and the work was started with the burin. All the forms actually originated with the burin, the vague white trace being used only to place and orient the composition.

First State: After about two days' work on the copper it showed only the loop: the first revolving figure (head down) was incomplete. There was no structure in the right side of the print. Two prints were made on January 1, 1946. Work with the burin was continued after the recumbent figure had been drawn in on the drawing. A previous version of this figure, in painting, was commenced early in December 1945.

Second State: This shows only the burin. The static figure and vertical separation to the left of the print, the recumbent figure and the plunging figure at the right, the whole structure of the composition was indicated. There was further detail in the spinning figure in the loop, and the direction of the space in the lower right corner was defined. The consequent figure, complementary to the spinning figure, was slightly indicated. Two prints were made on January 5, 1946.

Third State: This was not completed until January 18, 1946. Detail was added in the head of the spinning figure, development of the burin work was made throughout, and detail was supplied to the recumbent figure on the right and the plunging figure on the upper right. Two small white reliefs were added in the spinning figure to verify the proportion of white accents.

Fourth State: After some further burin work, the copper plate was coated with soft ground, filling all the burin lines and sealing them against the action of the acid. Various fabric textures, an irregular mesh of gauze, several different closely-woven silks and crumpled brown paper, were pressed into this ground, using the printing press,

with, in some cases, greater pressure applied to one margin of the plate than to the other. When the textures were removed the ground was lifted, exposing the plate. About four complete grounds were used at different times. The textures were superimposed in some cases at the moment they were applied, and in other cases a second or third ground carried the texture which was to overlap that already etched into the plate. The silhouettes of the bitten elements were defined by stopping-out with a varnish composed of resin dissolved in alcohol. The biting was done in a bath of saturated solution of potassium chlorate to which had been added about 10 per cent hydrochloric acid, that is, a more concentrated Dutch mordant. Practically every bite was varied by tilting the plate in the acid, and allowing it to creep across the surface, as well as by the variations of pressure in the transference of the textures. Spotting in certain places was produced by leaving scattered drops of acid in places during the tilting operation. Though biting follows the lines of engraving in some cases, it is most generally planned in counterpoint. The biting was controlled in view of the effect the transparent grays would have in modifying the three colors to be used. The forms of the bitten textures, although not indicated in any drawing, are consequent upon the linear forms and rhythms already established in the plate.

The Fourth State was printed on January 30, 1946. Prints a, b, and c show slight changes due to removal of overbitten tones in the lower center with water of Ayr stone and the burnisher. At this point the distribution of the color was worked out roughly on tracing paper, using transparent inks of orange, red-violet and green to serve as a control in setting up the screens.

At this point, also, the composition was incomplete. The triangle in the upper center was still empty. It was to be completed by printing green over violet, a combination producing a blue, with lines of clear color.

The method to be used for color printing was first considered in 1930 in Paris, when some experiments were made by applying surface color with a roller to an uninked plate, making one impression, then cleaning the plate and inking it, for intaglio printing, in black and reprinting on the same paper. Owing to errors in registry a black/white line, apparently in relief, was given. Stencils were used to define areas of color, which, in this case, were crude and detached. Later, in San

Francisco in 1940, a print, *Maternity,* was made, in which one opaque color, orange, and two transparent colors, blue and ochre, were printed in tempera on damp paper, using silk screens to replace stencils, and finally overprinted with black in intaglio from the plate. In 1943, another color print, *Centauresse* (Fig. 53), was made in which red, yellow, green and blue elements of oil color were applied to the surface of an intaglio plate previously inked with, violet: this provided the only transparency to modify the four colors. Though some prints were made with two successive impressions, the first being offset from stenciled color on the surface, the second being the intaglio impression, it was found that all colors could be assembled on the plate without mixing, if suitable media were used, and transferred to paper in a single impression, thus avoiding all the difficulties of register.

In this *Cinq Personnages* plate, I proposed to employ silk screens instead of the stencils used in the *Centauresse* experiment. The large scale of the plate and the complicated overprinting in transparent color which was planned means that stencils were not applicable. The plate was to be inked in black, as for normal intaglio printing, and then, by using silk screens, three successive films of color were to be deposited wet upon the surface without mixing with the black. The whole was to be transferred to damp paper by means of the roller press, in one single operation. On the print, color would appear as offset from the plate surface and, over it, would be the intaglio impression in black, appearing slightly in relief above the surface of the paper. Relief whites, hollowed-out spaces in the plate which were uninked or cleaned out, would appear in front of the grayish whites of unworked and uncolored plate surface.

Experiments in the additive use of color had been made in January and February 1946 with drawings in transparent inks, using the same four colors, orange, red-violet, blue-green and black. The method proposed, when technical difficulties had been overcome, would permit a certain sort of effect to be produced, but it was to be in no respect a means of reproduction. Many effects obtainable in paint would not be realizable, and only a composition planned from the beginning with a full knowledge of the limitations of this method would be successful. However, as in paintings of 1944 and 1945, I had found that the closely knit series of tones, produced as the consequence of the interference of very few colors, gave a psychological unity which a more complex

palette did not. Pavel Tchelichev tells me that many of his compositions were planned in this way.

As an oil medium would be used in the printing, the silk screens were prepared with glue solution, openings exactly the size of the plate being left, and color lines were drawn in with lithographic tusche and a ruling pen. These were subsequently washed clear with turpentine in the usual fashion. Stopped lines were drawn with glue, using the same pen. Registration with the black was simplified by the fact that the plate was visible through the screens while the work was being done. Some scattering of color, outside of definite color areas, was obtained by using a deliberately thin film of glue.

In practice, owing to accidents and the presence of insufficient margins on the first screens, it was necessary to remake both the orange and the green screens before a satisfactory result was obtained.

The screens were hinged to boards on which mats were cut out to fit around the plate, attached so that register would be automatic.

The appropriate medium, which would permit screening with a thin film of color, to avoid clogging the surface of the paper so that it would reject the black, which would not spread under pressure, and would not mix with the black nor bleed when all the colors were wet on the plate, took about two weeks of experimentation to find. The order of succession of colors turned out to be very important when set up on the plate. Intaglio would be deepest, followed by orange, red-violet and blue-green, so that on the paper they would appear in reverse order, the last color applied being undermost. However, the controlling factor seemed to be that amount of color, previously deposited, which was lifted by the two following screenings. Finally the best succession was found to be green — violet — orange. A soft Japanese paper, Kochi, with three blankets and light pressure, was found to print best. Printing was done where possible by the artist, who handled all intaglio inking and final impressions. Three helpers, one man to each screen, printed the colors, cleaned the undersides of the screens and kept color mixed and ready. The color did not add more than thirty seconds to the time needed to make each print.

The Fourth State in full color was run successfully on March 5, 1946. Two prints were made. The colors used were cadmium orange, thalo green (chlorinated copper phthalocyanine), and alizarin violet. The latter, not being obtainable, was ground from the pigment. Hand-

S. W. Hayter. Cinq Personnages, 15"x24" Buchholz Gallery.

Fig. 68

grinding of a quantity sufficient for fifty final prints and thirty trial prints took ten hours.

The plate was then completed by further burnishing on certain parts, by the accentuation of certain burin passages and the removal, with scorpers, of hollows to print white, or color, in relief.

Fifth State: This work was completed on March 7, 1946, and prints in black were made. Some modifications of the screens were made at the last moment, suggested by errors in some of the trial prints. Then progressive proofs were printed—black plus one color, and black plus two colors. The final series of fifty prints was made in three periods, totaling about twenty-six hours. Although some thirty prints were lost before the correct conditions were found, in the final printing only seven prints were imperfect.

Mr. Ezio Martinelli of Philadelphia helped in setting up the screens, and Messrs. Frederick Becker, the late James Goetz, and Karl Schrag, all of New York, assisted in the printing.

HISTORY OF THE TECHNIQUE

CHAPTER

11

GRAVURE AS ORIGINAL EXPRESSION (15TH AND 16TH CENTURIES)

Engraving, using the word in its simplest definition, the decoration of a surface with incised lines, seems to have been one of the earliest techniques of art. As early as any of the prehistoric drawings and sculptures, perhaps even earlier than sculpture in the round, primitive man engraved designs in line on rock, slate, horn, and bone (Fig. 64). It is curious to compare these engravings with the line cut in copper by artists today. Even when the line has been made by hammering a pointed instrument held diagonally in the direction of the curve it still has the quality of the driven line of the burin, in which the artist travels with his line instead of regarding his hand executing an arabesque at arm's length.

The Sumerians, who already possessed a method of printing cuneiform characters on clay with two arrow-shaped tools, made cylindrical seals which not only printed the signature of the owner on a clay slab, but did this printing with a rotary motion (Fig. 65). Such a seal, filled with an oily black, could function like the roller of a rotogravure machine. But true printing had to wait for the invention of paper, and it
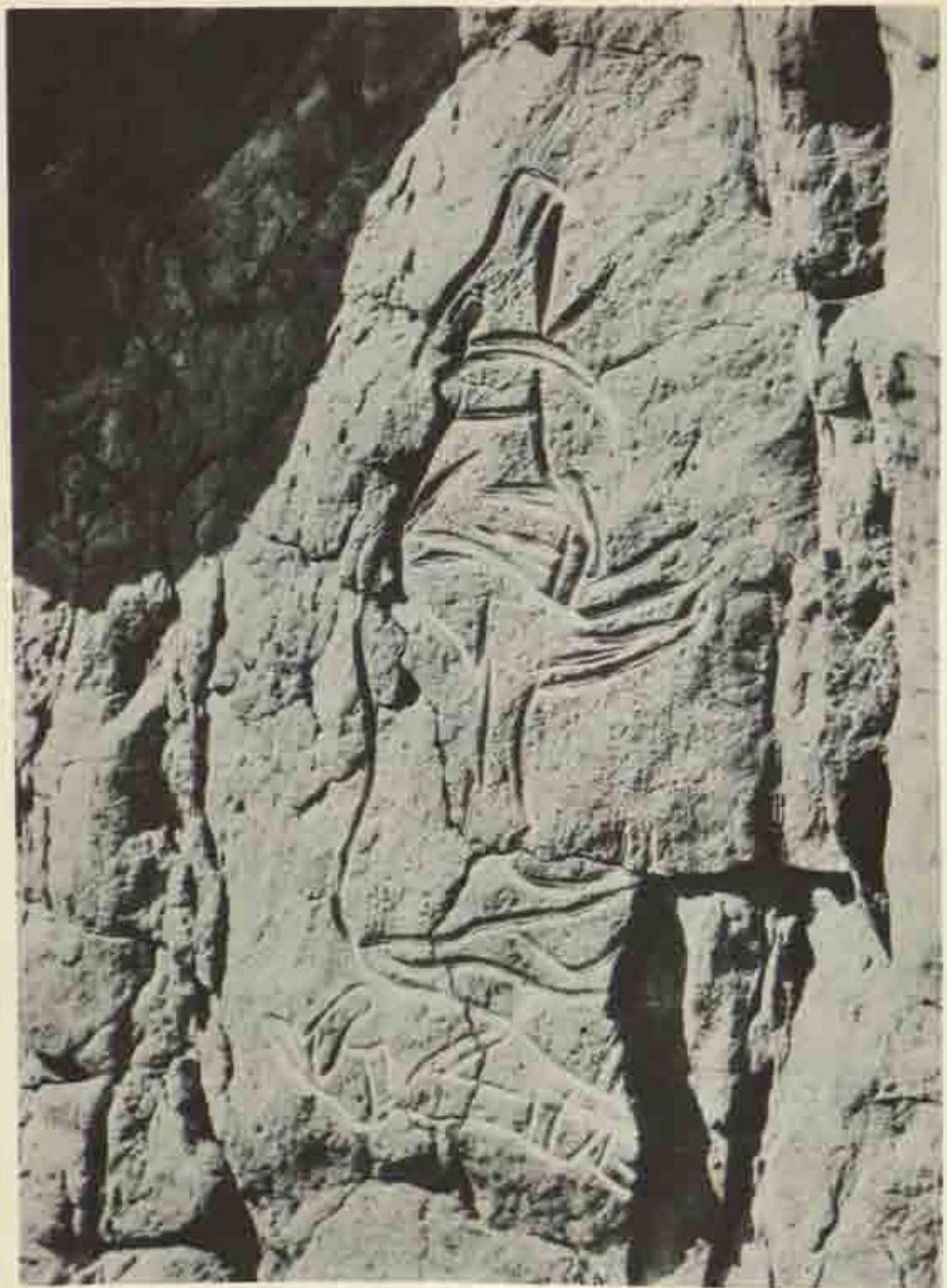
Fig. 64. Fezzan, Habeter (Africa): Man with a Donkey's Mask Driving
What Looks like a Water Buffalo. Prehistoric Rock Engraving
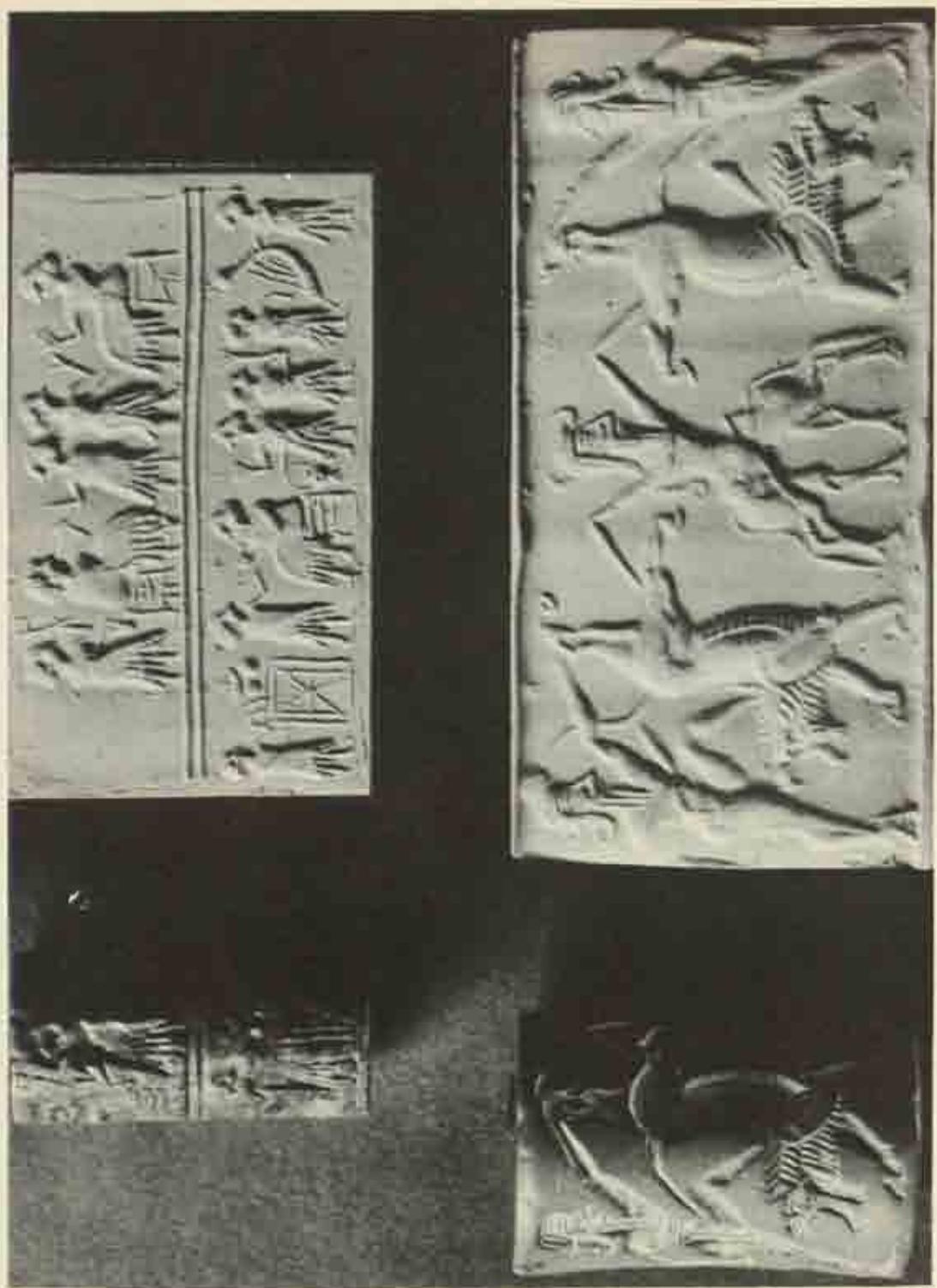
Fig. 65: Sumerian: Two Cylinder Seals with their Impressions

Fig. 66. German School (15th Century): Death and Assumption of the
Virgin. Criblé

Fig. 67. Abraham Rattner: Crucifixion, 1947. Engraving, Crible, and Aquatint

is surprising that it did not appear in Egypt even before its legendary invention in China.

In Exodus 28:36 there is a clear reference to engraving in gold for the decoration of the Ark of the Covenant, and by the time of Solomon and the bronze doors of the temple, the craft must have been well established. As was to be expected, in Europe the workers in precious metals, the goldsmiths, were the first makers of prints from their engraved plates.

Printing from the surface of wood blocks was known a century before the first intaglio prints. The small pressure needed could be more easily applied by the primitive means available. The rolling pressure required to squeeze the ink out of the grooves of an engraved plate was harder to apply. In fact, some of the earliest prints appear to have been rubbed with a burnisher from the back.

Early in the fifteenth century a method of making the hollows in the plate was current which is known as *criblé*. Points were hammered into the soft metal, and printing was sometimes done from the surface, the hollows remaining white, but often, in the same print, parts of the plate would be filled with ink and the surface wiped clean. Thus two methods of printing were employed simultaneously. It is possible that in such prints we might find the origin of intaglio printing, but, as no artist of importance employed the method, it had little development, though recently certain modern artists have re-employed *criblé*, and the simultaneous printing in intaglio and relief from the same plate is used by the artists of Atelier 17. One print in this manner, to which, on what evidence I do not know, the date 1406 has been assigned, might be the earliest example of intaglio printing (Fig. 66). A modern example is shown in Fig. 67.

The men who made those earliest prints in Italy and Germany were not, as the term is now understood, artists. They were primarily artisans and they either kept a shop in one of the free towns or were domesticated in the household of a noble or a prince of the Church. The workshops could employ men who were at the same time among the greatest artists of their day. A method much in vogue at this period was to engrave on silver or copper, filling the cuts with a paste of copper, silver and lead filings mixed with sulphur. The plate was then heated to fuse the black sulphides in the lines, so that, when polished, they would appear black on the bright metal (Fig. 68). The name of

170

this process is *niello*, and similar work is still being done in Iran, Irak, and India. I have seen Syrian silversmiths in Amara filling their plates with a mixture of antimony, silver, and charcoal dust which, when reduced by heat, gives a slightly bluer color than the black of the *nielli*.

Fig. 68. Anonymous Italian (15th Century) Abraham and Isaac with Two Servants on the Way to Mount Moriah. Niello

Giorgio Vasari states that Maso Finiguerra (1426–1464), whose workshop continued in his family for three generations, was the actual discoverer of printing from an engraved plate. This claim was, at one time, admitted, but it now seems that printing was well known before his time in the north of Europe. Prints are known of this period which were quite obviously intended primarily for decorative purposes rather than as prints; this is shown by the presence of holes at the corners, intended for attachment, and the fact that inscriptions often appear in reverse. In the workshops it was a common practice to make a press-

Fig. 69. Master of the Hausbuch (15th Century): Apprentices, Engraving

Fig. 70. Martin Schongauer (1445?–1495). Death of the Virgin.
Engraving

ing in clay to follow the progress of the work: sulphur was sometimes melted, and a cast, even a cast of the clay pressing, was made. As engravers still rub oil and powdered charcoal into the finer parts of their work to make it more visible, this is still another possible source for the practice of printing.

To abandon unprofitable speculation about the mechanism of the invention of printing, there is one fact that emerges clearly from the study of the prints of this earliest period. This is that, within two generations, a mere half-century after its invention, it had arrived at complete maturity, and within a third generation, it had become converted to another function entirely. In Italy one series of the so-called Tarocchi cards appears at about the same time as a number of masters known only from the monograms or initials on their plates, and the Master of the Hausbuch (Fig. 69) is, perhaps, even a little earlier than the cards.

There was already a very definite difference in style between the northern and the southern schools. The Italian examples show a definite line profile; modeling was then applied with fine parallel lines running diagonally from the lower left to the upper right on the print, which is the most natural direction on the plate if set before the artist. (The most natural direction on scratched or pulled lines would be the reverse.) The modeling in these early "fine-manner" prints is weak, and closely set, and in the later impressions it has often been reworked. The subject is generally a figure without any organization of the surrounding space, and the modeling describes the surface as sculpture rather than indicating lighting. In Germany and Flanders, with the Master E.S. (known only from his initials) and Martin Schongauer (1445?–1495), a far more elaborate technique was already in use (Fig. 70). This employed cross-hatched passages giving variations in texture as light and color, and dotting, generally with the flicked dot, printing as a lozenge-shaped point. The attempt to make a picture, to describe a landscape about the central figure, and the deformation of the firm curve proper to the cutting tool into the most involved arabesque of the Gothic spirit, contrast with the sculptural character of the goldsmith's preoccupation with the metal. The factor that seems to distinguish the engraving of the Italians from that of the Northerners was the influence of the Renaissance. It is sometimes difficult to realize that Antonio Pollaiuolo (1429–1498) and Andrea Mantegna (1431–1506)

174

definitely thought that they were recreating the art of ancient Greece (Figs. 71, 72).

Pollaiuolo was perhaps the first great artist to use engraving in Italy. He is known to have been associated with the Finiguerra family workshop in Florence at the time when they were producing many *nielli*, and the dark background of his *Battle of Naked Men* (Fig. 71) is supposed to have been influenced by the work he must have done in that medium. The figures are described with a flexible but heavy outline, which is attached to the background. Within the space thus defined, modeling, as with Mantegna and his school (Figs. 72, 73), is carried out with diagonal parallel lines which do not often touch the outline, and between these lines a second series of finer lines are laid in the same direction at a slight angle to the first but without crossing. These *contretailles* have been explained by most museum authorities as an attempt to follow the return stroke of the pen in drawing. I doubt whether any working engraver would have thought of such a solution, for if he intended to do this it would be simple to turn the plate upside down and cut them in the reverse direction. To understand the purpose of this technique I think it is sufficient to regard the general effect which the artist has achieved. The whole plate is a sort of relief, in which the hollows of the background all return to the level of the plate at the margins. Within the hollowed space the outlines of the figures cut out spaces in which a complete volume revolves. If the hatchings were connected solidly with the outline the effect would be half-round instead of a complete solid.

We know that Italian art of this time was very preoccupied with "the Antique," which was, in the case of Mantegna, Aretine pottery and Greco-Roman sculpture. In all of the plates of the school of Mantegna the space described is limited, as it is in bas-relief, but the sculptural effect of the cutting in metal is used to make the recession within this limited space concrete (Figs. 72, 73, and Master I. F. T., Fig. 74). The modeling on the figures is arbitrary, and is not a matter of light and shade; progressive darkening follows the turning of a plane consistently and thus describes a volume rather than the effect of light on it. The effect is so powerful that even the definite lines which Mantegna uses to describe local modeling within the main volume does not destroy the magnificent weight and solidity of the figures.

In Germany, Martin Schongauer was followed by Albrecht Dürer

175

Fig. 71. Antonio Pollaiuolo (1429–1498): Battle of Naked Men. Engraving

Fig. 72. Andrea Mantegna (1431—1506): Battle of the Sea Gods. Engraving

(1471–1528), perhaps the most astonishing virtuoso of engraving. A great painter, he made woodcuts, probably executed by *Formschneider*, he engraved on copper, and made dry points and etched on iron. He knew Jacopo de' Barbari (1440?–?1516), the Venetian engraver, visited Italy at least once, and copies by him of Mantegna drawings are known. Like many other very original artists he borrowed freely from his contemporaries, just as Rembrandt, Manet and Picasso have done. But in his hands the point or the burin became different instruments from these same tools in the hands of the Italians. He is supposed to have acquired his preoccupation with proportion from de' Barbari, but in his copies of Mantegna there is more of Dürer than there is of his model. Where a strong, simple fold appears in the original, Dürer cannot resist the temptation to torture the fabric into a few twisted tucks in the corners nor can he avoid the angular stiffness of the drapery (Fig. 75). His vision and conception of the plate is pictorial rather than sculptural; the massing of light and shade is not to be considered as inferior or superior to that of the Italians. It is merely completely different in aim and intention. His language is dramatic, and graphic, but not plastic. In execution he employs every variation of cross-hatching, alternate dot and line, and lines of different weight to obtain texture, even to acquire a color equivalent. He rarely employs the violent accents in the cutting which are typical of Mantegna.

Dürer also made a number of etched plates (Fig. 76). The process must have been known as early as the thirteenth century, as armorers used to coat steel with wax, draw designs through it and etch or corrode the trace with salt and vinegar. Printing from such plates does not seem to have been done until printing from engraved plates was common, and the process seems to have been regarded as a quicker, but less effective, way of repeating the effects of engraving. Although acids capable of etching copper were known in this period they do not seem to have been generally available, as all of the earlier plates were of iron, and the bitings were uniform, without variation of intensity.

Dürer traveled to other parts of Germany and to the Netherlands. His work was not only seen but copied in Italy. The technique of Giulio Campagnola (c.1484–c.1563) combines dotting and cross-hatching with the severe form of the school of Mantegna (Fig. 77). In the Netherlands Lucas van Leyden (1494–1533) was etching on copper and was probably the first to do so. In Switzerland Urs Graf (d. 1527) etched

178

Fig. 73. School of Mantegna: Descent into Limbo. Engraving

Fig. 74. Master I. F. T. (15th Century): Hercules and Hydra. Engraving

Fig. 75. Albrecht Dürer (1471–1528): The Prodigal Son. Engraving

Fig. 76. Albrecht Dürer (1471–1528): Man in Despair. Etching

Fig. 77. Giulio Campagnola (c. 1484–c. 1563): St. John the Baptist.
Engraving

Fig. 78. Albrecht Dürer (1471–1528): Adam and Eve, 1504. Engraving
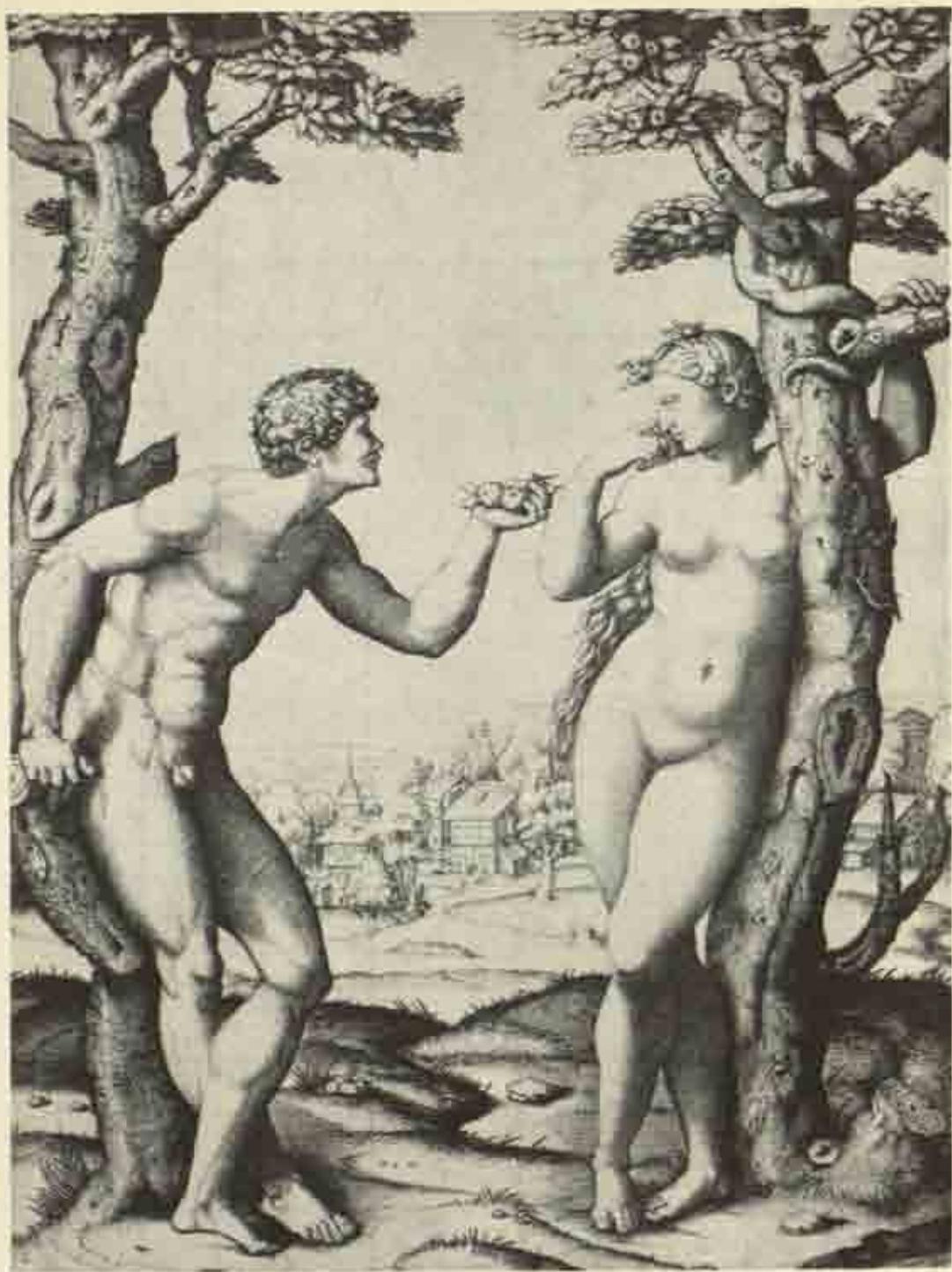
Fig. 79. Marcantonio Raimondi (1475?-?1534): Adam and Eve. Engraving.

plates of iron. Daniel Hopfer (fl.1493–1536) at the turn of the century made some of the earliest etched portraits. The process of engraving, first used by goldsmiths to decorate metal surfaces, was applied by great artists to original expression. But already engravers, like Zoan Andrea of the school of Mantegna, were using the method to reproduce the master's drawings, apparently without consulting the author. In fact, it is reported that Mantegna assailed Andrea and Simone de' Ardizzone in the streets of Mantua for one of those breaches of copyright, leaving them for dead.

The northern style in which the free cut of the burin, that is the line obtained by swinging the plate against the cut of the tool, was deformed to render the calligraphic line which those masters sought, was beginning to find many imitators in Italy. As soon as the inherent quality of the work on metal was neglected in favor of pictorial representation the way was open for the conversion of an original medium of expression into a means of translation from originals into another medium. Original engraving had had less than a century of life, and, although it does not disappear entirely from this point, it is now the exception, and practitioners of original printmaking in engraving are freaks.

Marcantonio Raimondi (1475?–?1534) was an engraver of extraordinary facility. He was not without considerable ability as an original artist, but he chose to reproduce the works of Raphael rather than his own. He had a power of acquiring techniques with such authority that they no longer belonged to his precursors. A comparison between the *Adam and Eve* of Dürer and the Raimondi plate of the same subject is interesting (Figs. 78, 79). His borrowing from Dürer is unmistakable even if we did not know that he had engraved copies on copper of Dürer's woodcuts, not omitting the monogram.

He was engaged by Raphael, who realized, with great business acumen, that the employment of such an engraver could be of enormous financial advantage. Together with others of the school of the engravers of Raphael, he engraved from the cartoons of his pictures under the direction of the master, who is supposed to have even corrected the outlines of certain of the figures. Later reproductions made by members of the school after the death of Raphael are so much inferior to those made under his direction that one realizes the importance of this factor. Raimondi, however, made many of his finest plates at this

time. The perfection of these reproductions had so convinced the public of that epoch that young engravers found no incentive to revive a mode already abandoned and re-invent original expression in a medium already dedicated to the fame of the painter.

CHAPTER

12

CONVERSION OF GRAVURE TO REPRODUCTION

In the consideration of the techniques developed or invented for the purpose of reproduction—for the imitation in prints made from plates of the effects proper to other media—I propose to include the study not only of the methods of those engravers, like Hendrik Goltzius (1558–1617) or Boetius Adam van Bolzwert (1580–1638) and his brother Schelte van Bolzwert (1581?–1659), whose work was chiefly reproduction of the originals of other artists, but also of those original artists whose methods were derived from the reproduction process, even though their use of them raised their work above the category of mere reproduction.

Most of the history of engraving from the seventeenth to the twentieth centuries falls into this category. Those exceptional artists who invented methods for original expression even when, as in the case of William Blake, their work includes conventionally executed plates, will be referred to again in the following chapter devoted to the restoration of original expression in print-making.

188

Fig. 80. Jean Duvet (1485–c. 1561): Detail from "Apocalypse." Engraving

In Flanders, directly following the school of the engravers of Raphael, the engravers of the school of Rubens, Lucas Vosterman (1595–c.1675) and the Bolzwerts continued the translation of painting

Fig. 81. Claude Mellan (1598–1688): Portrait of Girolamo Frescobaldi. Engraving

effects into engraving. The connection between the schools was very intimate, as some of these men were trained in Italy by the school of Raphael. They developed imitative textures with interwoven engraved lines and dots further than the Italians, with the exception of Raimondi, whose technical virtuosity is hardly excelled until the time of Goltzius.

Fig. 82. Robert Nanteuil (1623?–1678): Portrait. Engraving

Fig. 83. Hendrik Goltzius (1558–1617): Standard Bearer. Engraving.

Fig. 84. Francesco Bartolozzi (1725–1815): Allegory. Stipple

As we have already seen, the means by which engravings were made had become organized into the "Schools of the Engravers of" this painter or that, but, in Italy, a new method of distribution appeared. A bookseller or a printseller would order or have made prints by various engravers. Barière in Rome and, later, Hieronimus Cock in Antwerp, had their stable of artists—often mere hacks—who produced works for the print shop, generally from drawings made to order or purchased from the artists and published under the imprint of the dealer.

In France, Jean Duvet (1485–c.1561), an isolated engraver, applied the characteristic methods of reproduction engraving to the representation of an Apocalyptic Vision (Fig. 80). Yet even an artist of his powerful vision could create nothing in the copper which could claim an independent existence. The mannerism in the use of parallel lines, somewhat similar to that of Jacopo de' Barbari, is not sufficient to remove his work from the interpretative category.

Francis I had imported Italian painters to make frescoes at his palace of Fontainebleau, and some of these artists of the school of Raphael made engravings after their own paintings. The prints of the school of Fontainebleau, mostly by Italian hands, undoubtedly influenced later engravers in France.

The methods inherited from Raimondi and the school of Raphael were developed in France for purposes of portraiture by Claude Mellan (1598–1688), Michel Lasne (1590–1667), Antoine Masson (1636–1700), Robert Nanteuil (1623?–1678) and others (Figs. 81, 82). Mellan employed a mechanical "swelled line" to describe chiaroscuro with extraordinary fidelity; his *St. Veronica* is a single uninterrupted irregular spiral starting from the nose of the face and describing by its variations of thickness every variation of value. It is an achievement of penmanship rather than of engraving, as the copper never shows itself at any point.

The Renaissance influence in the rigidity of sculptured borders and decor in many of these portraits has been transposed into another dimension from its effect on the school of Mantegna. While the latter tried to recreate their classical model, the French engravers imitated, with great ingenuity, the surface of the object.

In England, engraving, on a basis of cruder drawing than the Italian, Flemish, or French examples, was firmly established in the sixteenth

194

Fig. 85. Jean Charles François (1717–1767); Allegory. Crayon Method

century. Rogers' portrait of Queen Elizabeth is attractive for its stiff naïveté, but technically it is no more than an unskillful attempt to reproduce the quality of a painting. The interest of such prints is chiefly documentary or historical. In them the function of the technique is imitative and, when most successful, bears no trace of the copper on which it is executed.

Goltzius, in Flanders, perfected the weaving of the cross-hatched lines, the webs of alternate heavy and fine cuts, with dotting in the intervals of cross-hatched passages (Fig. 83). His ingenuity, however, serves to reproduce the surface of armor, of velvet, of flesh, of satin and so on and never allows the metal of the goldsmith to be felt.

During this time, the art of etching, at first regarded as a rapid means of imitating the effects of engraving, had developed considerably, with copper taking the place of iron as stronger mordants became more generally available. Bitings, which had previously been uniform over the whole surface, were varied by stopping-out.

The seventeenth century found flourishing schools of gravure in France, the Netherlands and England. Engraving was still called upon to represent the effects of painting, but in the reproduction of drawings even greater verisimilitude was required. Dotting by the use of a special tool (stipple) was developed by Francesco Bartolozzi (1725-1815), and although this method had been used by Domenico Campagnola, it now became a mechanical process for the reproduction of the values of drawing (Fig. 84).

A step further in the accurate reproduction of texture and the quality of chalk and crayon was the "crayon" method of Jean François (1717-1767). In this, small rollers with irregular surfaces were used to open dotted lines in a ground and the plate was then etched (Fig. 85). Printing from black and sanguine plates at this time simulated very exactly the sanguine and black drawings of Boucher, Watteau and Lancret.

But even softer and more dense printed textures were sought, to imitate the effects of painting. These were found in aquatint, which appeared in the seventeenth century with Adriaen Van de Velde (1636? -1672) and others (Fig. 86), and, towards the end of the century, in mezzotint. Ludwig von Siegen (1609-after 1676) is now considered to have been the first to employ mezzotint and Prince Rupert (1619-1682) introduced it into England, where its soft dense tones were so much

196
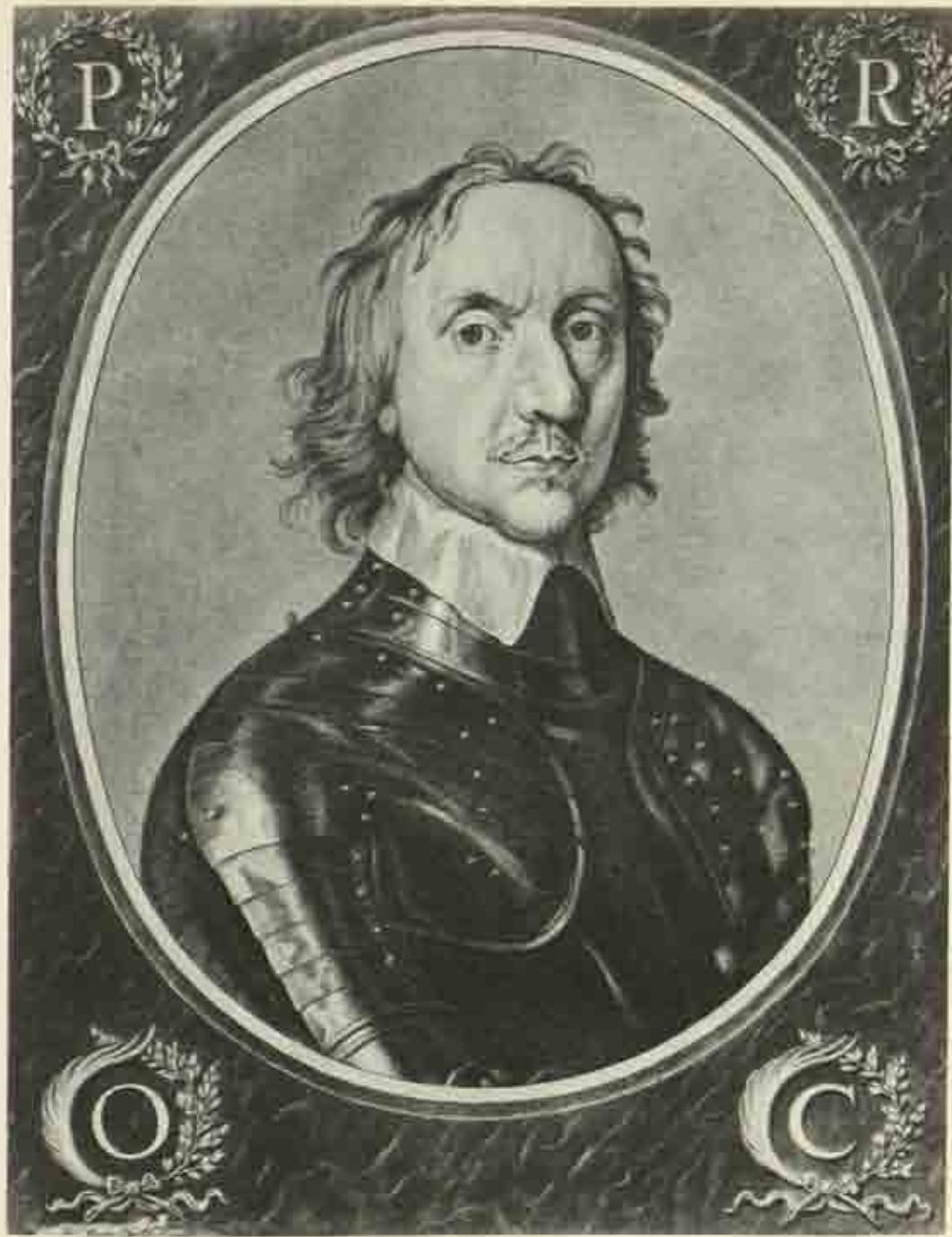
Fig. 86. Adriaen van de Velde (1636?–1672): Oliver Cromwell,
Engraving and Aquatint
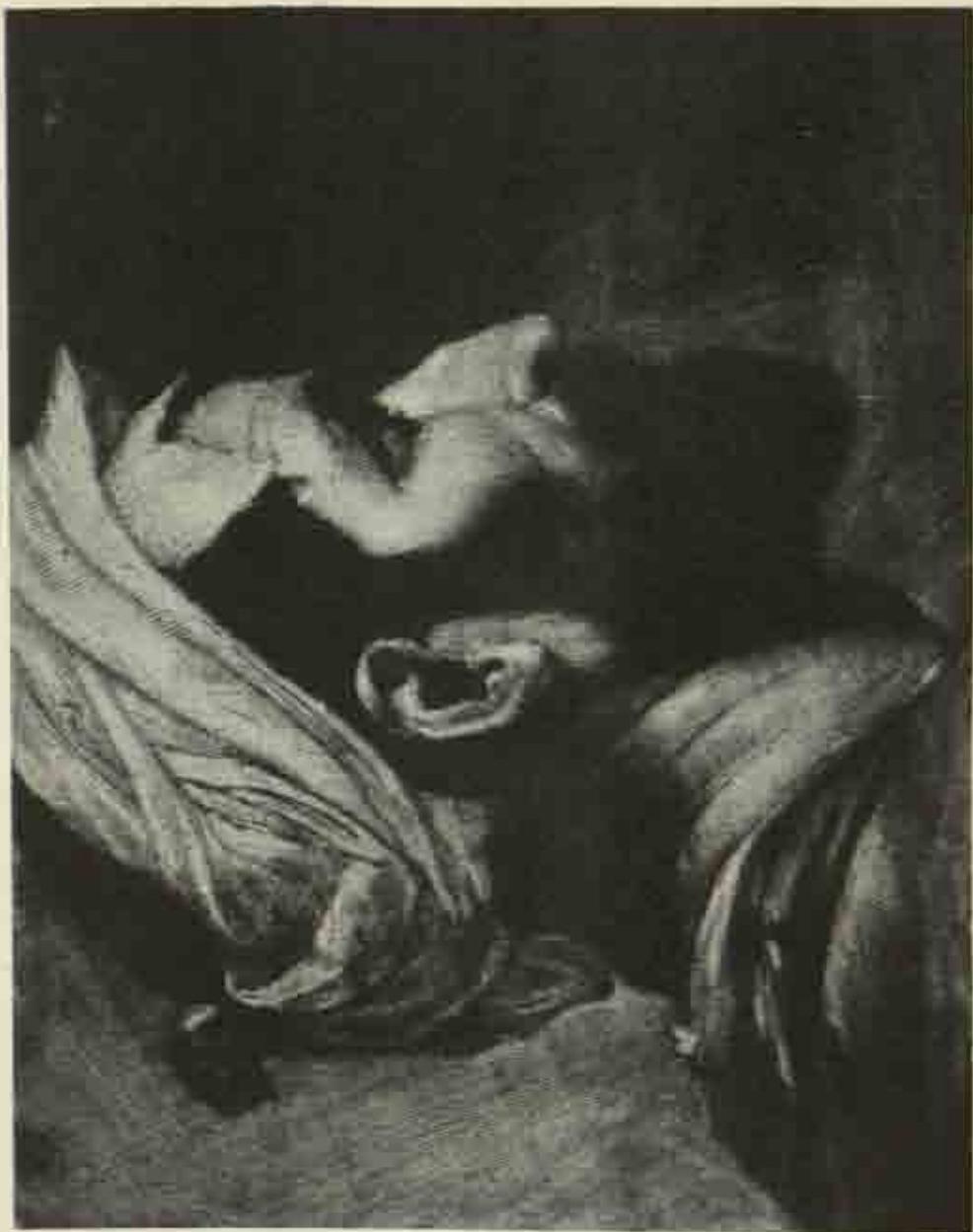
Fig. 87. Prince Rupert (1619–1682): Head of the Executioner. Mezzotint
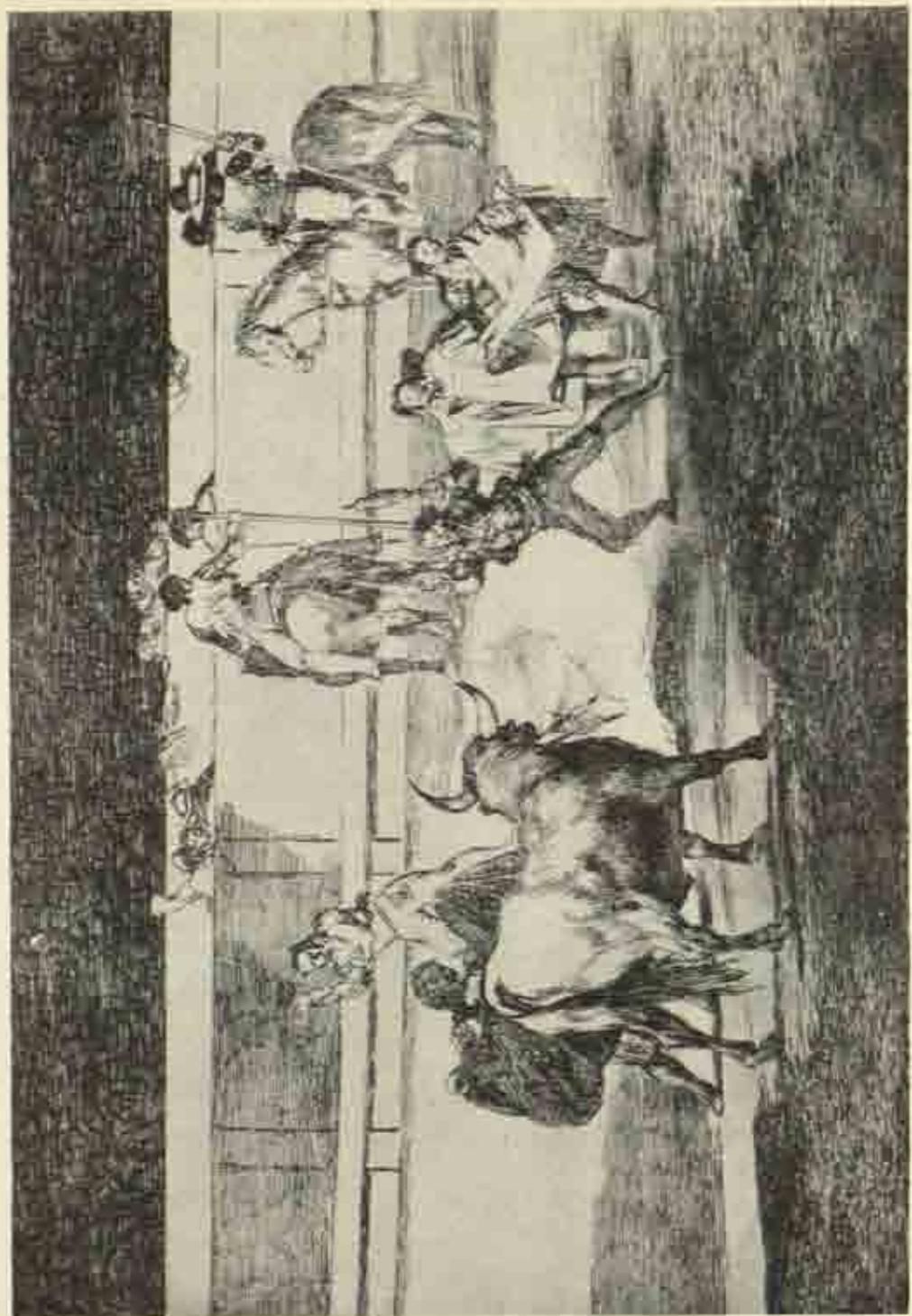
Fig. 88. Francisco Goya (1746-1828): Tauromachia. Etching and Aquatint

appreciated and employed that within a generation it became known as the "English Manner" (Fig. 87). Before the twentieth century, mezzotint was rarely used as other than a reproductive method; even those artists who employed it, George Stubbs, John Martin and J. M. W. Turner in his few plates, looked upon it as a means of reproducing their drawing or paintings. (Martin, it should be noted, was one of the earliest users of soft-steel plates to allow him to print enormous editions of his works).

Following the development of methods of translating into black and white values and finally even the brush strokes of painting, the printing from a succession of plates in color to introduce even this quality of painting was sought. Jacques Christophe Le Blond (1670–1741), using stipple or crayon method on successively printed plates in color, made prints which are extremely faithful. With the later application of color aquatint to reproduction, the imitation of painted surfaces became almost as perfect as the later photographic methods, and in some cases was perhaps even more accurate.

By the eighteenth century the rules of expression by means of engraving had become completely codified. There was so little incentive to explore the expressive means of the medium that such an engraver as William Hogarth, whose first known work, executed in his teens, was an engraver's card informing clients that he would undertake engraving for gentlemen, when prosperous enough to employ hacks, permitted them to engrave from his designs.

The nineteenth century saw the development of machine ruling, the invention of a burin with a turned-back point, like an adze, intended to cut when pulled instead of driven, and of enormous steel plates in which engraving, etching and stipple or mezzotint were combined to arrive at a photographic reproduction of a painting by a popular artist. Such plates, executed on soft steel and later case-hardened, could be printed in editions of thousands of copies. Another method, which also became common during the century, was the "steel-facing" of copper plates, by electrolytically depositing iron, and later nickel or chromium, on the surface, a process that gave the same resistance to wear in printing that the steel plate possessed, but enabled the engraver to work in the softer and more sympathetic metal.

Yet, in this period, we find Goya using aquatint in a broader and more expressive fashion than the engravers of the previous century,

200

showing what such a medium can become in the hands of an artist (Fig. 88). His plates, which I handled in Madrid in 1937, in spite of the numerous editions which were made from them after his death, had been steel-faced and were still in remarkably good condition. At this time a final and beautifully printed edition of some 500 plates was being made by Ruperes, one of the greatest printers I have known. (It is curious to note that Goya's plates are stamped with the mark of Wm. and Maxwell Pontifex of Longacre in London, the firm whose plates were also used by William Blake).

CHAPTER

13

RENEWAL AND NEW WAYS

Among the artists who made use of the means of reproduction but who also felt the need to go beyond that, there were five who are in some manner forerunners of the modern revival of the arts of engraving and etching. They are, as I have already indicated, freaks in their different generations: Hercules Seghers (1590–1640/5), who was apparently little esteemed in his own time, Jacques Callot (1592–1635), Rembrandt (1606–1669), who is generally regarded as the greatest master of etching, Piranesi (1720–1778), who was a fairly successful artisan, and William Blake (1757–1827), the poet who had comparatively little success in the England of his day.

Seghers (Fig. 89) worked with acids on curious grounds of his own invention, and may well have been trying to remake a sort of painting. A texture similar to that of many of his prints can be obtained by exposing a bitten plate for a short time to acid without any ground; the curious mottled line in another plate, by rubbing a thin film of oil over the needled plate when, owing to this film breaking down irregularly under the acid, the ground itself being weakened, the line spreads
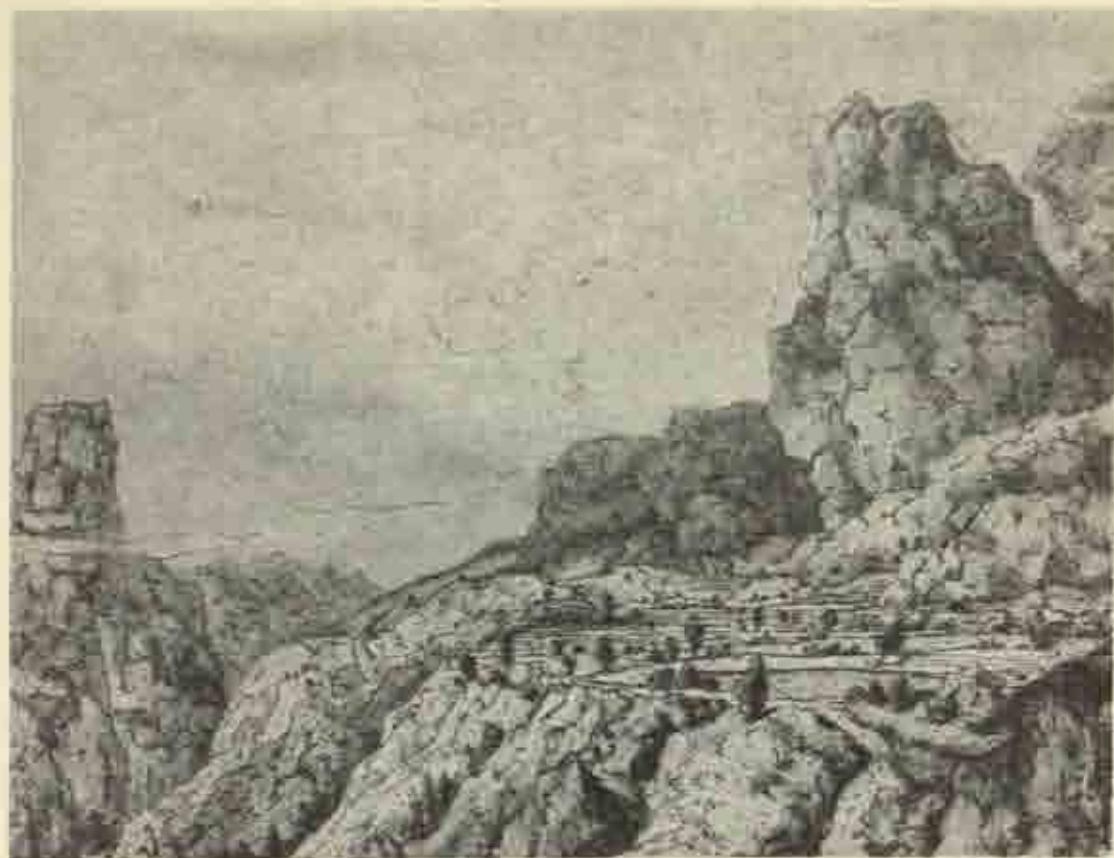
Fig. 89. Hercules Seghers (1590–1640/5). Landscape. Etching

somewhat as a pen line does on wet paper. He printed in colors, sometimes in relief, in white ink on dark paper, and on canvas (Fig. 57). Though many of the prints could have been printed over paper previously colored with watercolor and others could have been retouched with color after printing, I do believe, in certain examples, where the color varies very exactly with the form, yet is clearly under the line,

Fig. 90. Jacques Callot (1592–1635): Beggar. Etching

that he anticipated the simultaneous intaglio and relief color method used by Atelier 17. His well known *Tobias and the Angel* plate, in itself the reproduction of a painting, was reworked by Rembrandt, who transformed the quality and scale of the whole composition.

Jacques Callot (Fig. 90), using the characteristic reproduction methods of engraving of his time, but with fantastic wrongheadedness, made his plates by etching. With the echoppe (Fig. 4D), a needle with the point cut off at an angle to give an oval cutting edge, he could cut a line through a ground which has the characteristic swelling quality of

Fig. 91. Rembrandt van Rijn (1606–1669): The Large Lion Hunt.
Etching

Fig. 92. Giambattista Piranesi (1720–1778): Gli Carceri. Etching

a burin line. This quite illogical proceeding gives a curious accent to his drawing which could not, however, have been obtained with the burin.

Rembrandt (Fig. 91), in his most characteristic plates, uses the free stroke of the point purely in the sense of drawing, but with an intensity that few drawings ever attain and a power of description perhaps never equaled in the medium. The masses of dry point which focus light on a few salient points in later states of some of his plates seem like the arbitrary adoption of a convention of painting, and, as we gather from accounts of the time, he applied them somewhat against his better judgment. His technical virtuosity has lamentably influenced a school of etchers, who see art merely as an exhibition of skill.

Piranesi (Fig. 92), in his later years, was an efficient engraver of archeological and numismatic illustrations, and the greatest part of his work is of this character. But as a young man he made the famous series of *Carceri*, imaginary architectural scenes in which the means of etching create a viable space in defiance of logic, and in which the imagination builds concrete spaces which it would be impossible to realize in painting.

William Blake (Fig. 93), while still almost a child, was trained in the mechanical methods of the Italian reproduction engravers; at a time when he had as yet no identity as an artist to defend, these methods of describing flesh, terrain, clouds and water were firmly imposed upon him. In spite of a boundless imagination, exceeding that of any of his contemporaries, and indisputable courage in the use of the burin, he was never able to escape the discipline—though, in some parts of the great unsuccessful *Canterbury Pilgrims*, his attempts to do so are obvious. He was finally led to reverse the whole process of etching, drawing in acid-resistant varnish on plates and etching away for relief printing (Fig. 94). His methods of printing these plates have been explained in Chapter 7. He was almost destroyed by the bad taste and hostility of the England of his day, and those who might have employed him preferred the work of the dullest of Italian hacks, like Louis Schiavonetti, as do certain collectors of the present day.

The conditions for a renewal of the arts of etching and engraving as media of original expression emerged as soon as the public demand for the work of reproduction engravers had disappeared with the introduction of photomechanical methods. Yet this in itself would not have

Fig. 93. William Blake (1757–1827): The Circle of Thieves (from Dante's *Inferno*). Unfinished Engraving. The Work still to be done is outlined in Dry-Point

Fig. 94. William Blake (1757–1827): Page from *The Book of Loth*.
Relief Etching

been sufficient unless the movement of the art of graphic expression had made an insistent demand for these means.

Towards the end of the nineteenth century a transformation was taking place which affected not only the modes of expression used by artists, but also the relationship between the artist and his work, and that between the work itself and the public. This change was of course dictated by a change in the conditions of living, in the relations between individuals, and in man's mental attitude to the phenomenal world. In part these shifts were due to the social changes brought about by the enormous advances in the study of natural science and their application to every moment of the individual's life.

A considerable number of people will always resent change and will frequently oppose to changed conditions a stubborn determination to ignore them. There are artists who speak for these people, just as there are artists who speak for any other minority in a community. For these artists, new means of expression have very little value, and the existing means will always prove adequate.

A valid revival of the arts of engraving could spring only from strictly contemporary artists, whose relation to the real thought of their time was as intimate as it has always been with the old masters, though not necessarily their relation to public opinion when the public has been kept in ignorance and fear. It is therefore to be expected that, at about the beginning of the twentieth century, a false revival would appear, more particularly in countries where the principle of reality was held in small honor by artists trying to live in another age, possibly in a golden age that never was. So in England, America and France as well as in other countries, a variety of "original" printmaking appears, with the purpose of representing by the methods of drawing, scenes and objects, already within the grasp of the photographer, but colored with the atmosphere of Rembrandt, or, in some of the wittier examples, of Piranesi, and of Méryon (1821–1868, Fig. 95). It seems hardly necessary to insist that this atmosphere is no more convincing than a cloak-and-sword at a fancy-dress ball, but there was no lack of support for it, as there will always be enough people who are sufficiently disgusted with everyday reality to take refuge even in a fancy-dress ball.

A group in England, realizing some of the neglected possibilities of the burin, staged a sort of belated Pre-Raphaelite movement. A number of very creditable Schongauers and Dürers were produced by members
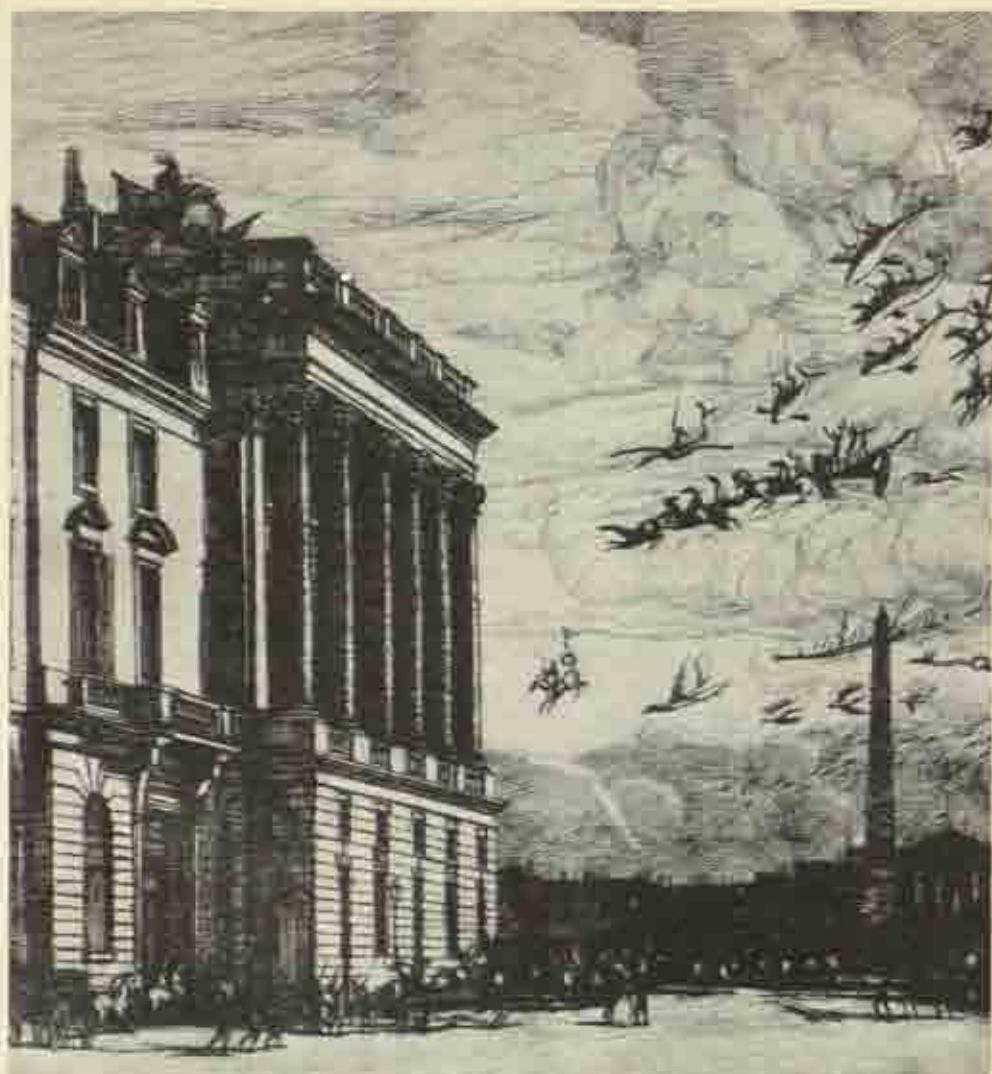
Fig. 95. Charles Méryon (1821–1868): Le Ministère de la Marine.
Etching
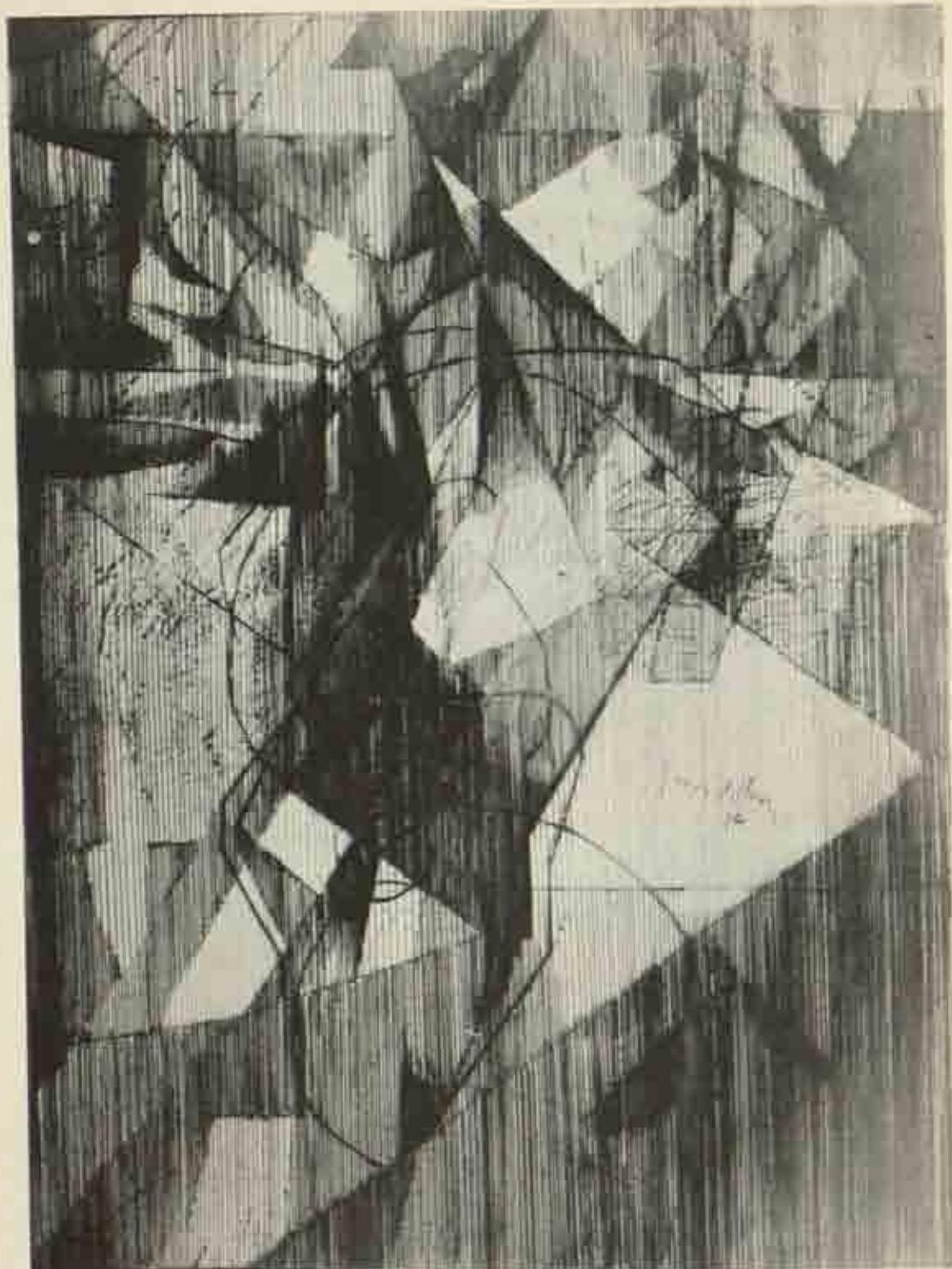
Fig. 96. Jacques Villon (born 1875): Equilibriste, 1914. Etching
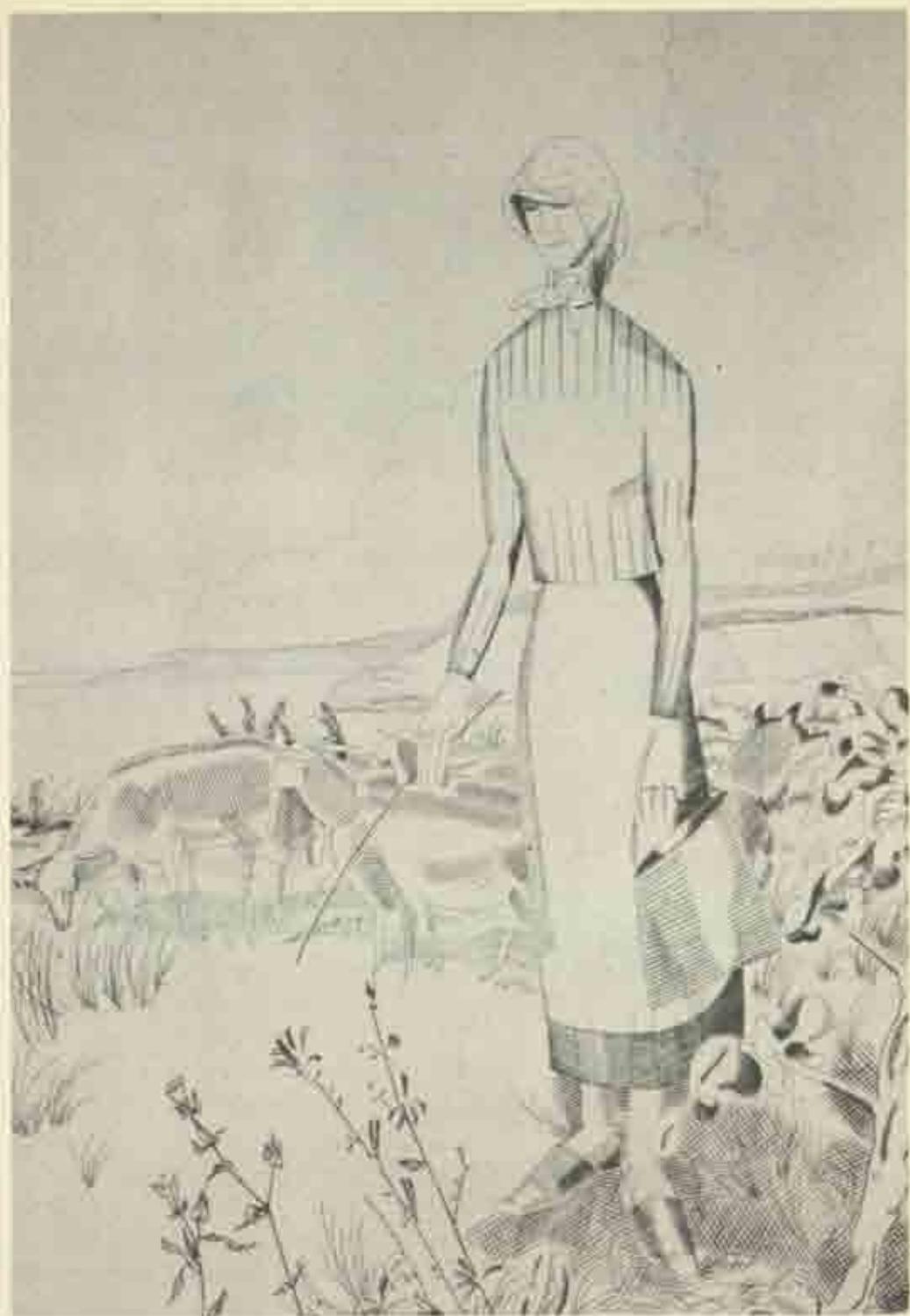
Fig. 97. Jean Laboureur (1877–1943): La Grande Bergère, 1926.
Engraving

of the group, some of whom arrived at a competence of execution almost worthy of their models. However, the world of Dürer and Schongauer is not ours, and such works, in my opinion, lack the first essential quality of valid art, an adequate motive.

The means by which modern artists arrived at a new use of the plate media are illustrated in the career of Jacques Villon (b. 1875), in my opinion one of the unacknowledged fathers of modern printmaking. Before 1900 Villon was making color aquatints of fashionable subjects which owed, perhaps, something to Toulouse-Lautrec, but his use of the medium was still solely reproductive. Later, however, as he was affected by the wave of Fauvism and Cubism (the realization of the initiative of Seurat and Cézanne), as early as 1910 he started to use interwoven webs of line to construct a cubist space (Fig. 96). Although during this time and for twenty years more he was employed in making some of the most accurate aquatint reproductions in color from the works of Picasso and others, yet, in his own work, he used the medium to construct the sort of space in which artists now operate, a very different space from that seen through the classical window of Renaissance representation.

At about the same time Joseph Hecht (b. 1891), a Polish engraver who finally settled down to work in Paris after passing through Warsaw, Berlin and Norway, had laid the foundations for the renewal of the use of engraving as a creative medium. Although, like Villon, he had learned the use of his tools from conventional reproduction engravers, he commenced to analyze the action of cutting with a burin into copper, and to construct from the most elementary and simple strokes of the tool an image which should have a discrete existence of its own, not merely a vicarious existence in terms of its dependence upon some third object. At the same time he possessed an extreme sensitivity to all the qualities of a line—rigidity, flexibility, resilience —and saw the character of life in the line itself, not the description of life by means of the line. An examination of the prints of Hecht reproduced will show that there is not a limp or dead line in them (Figs. 6, 21, 99, 109, 115).

Jean Laboureur (1877–1943) was working at the same time in France, using the same tool, although with different results (Fig. 97). Unable to escape entirely from the mechanical quality of reproduction engraving, he did offer an image in other terms than the English school. His

214
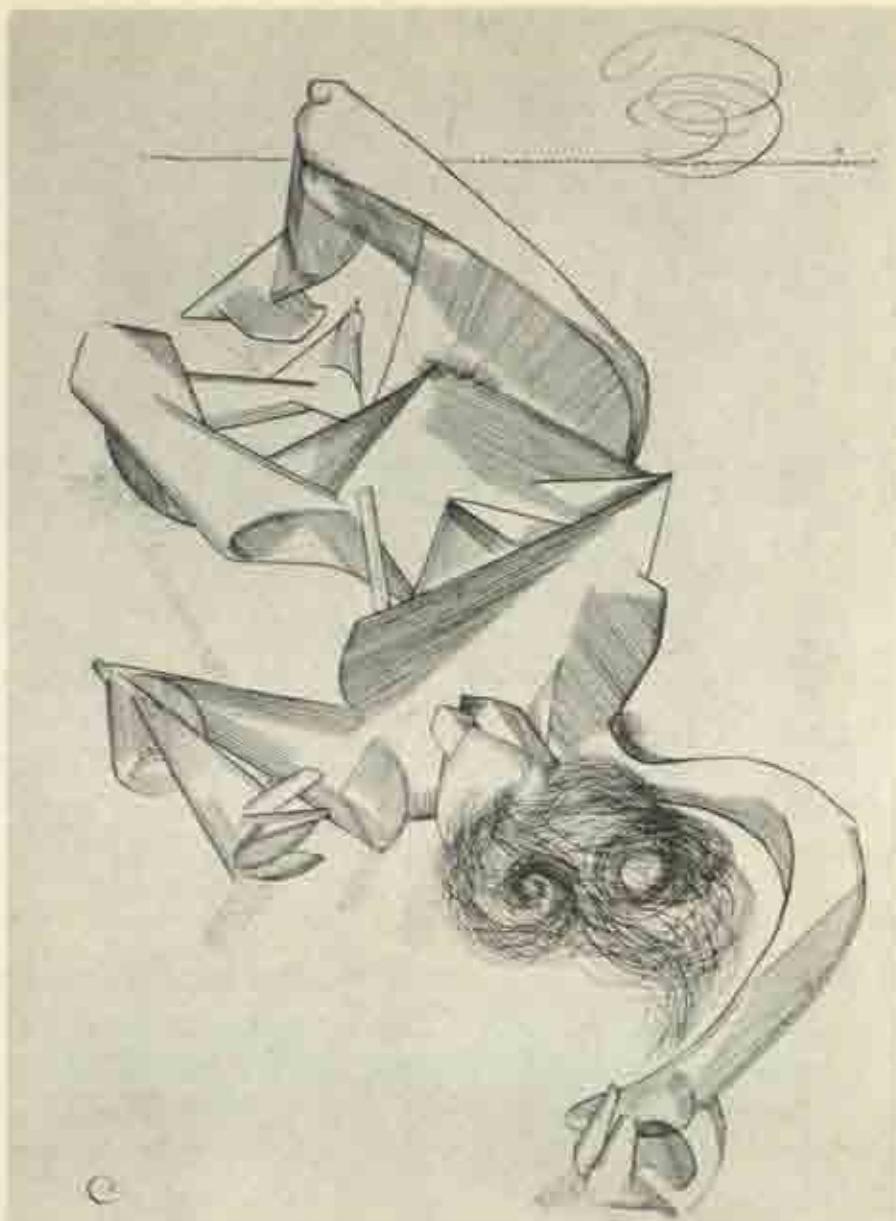
Fig. 98. Pierre Courtin (born 1921): Femme Couchée. Engraving
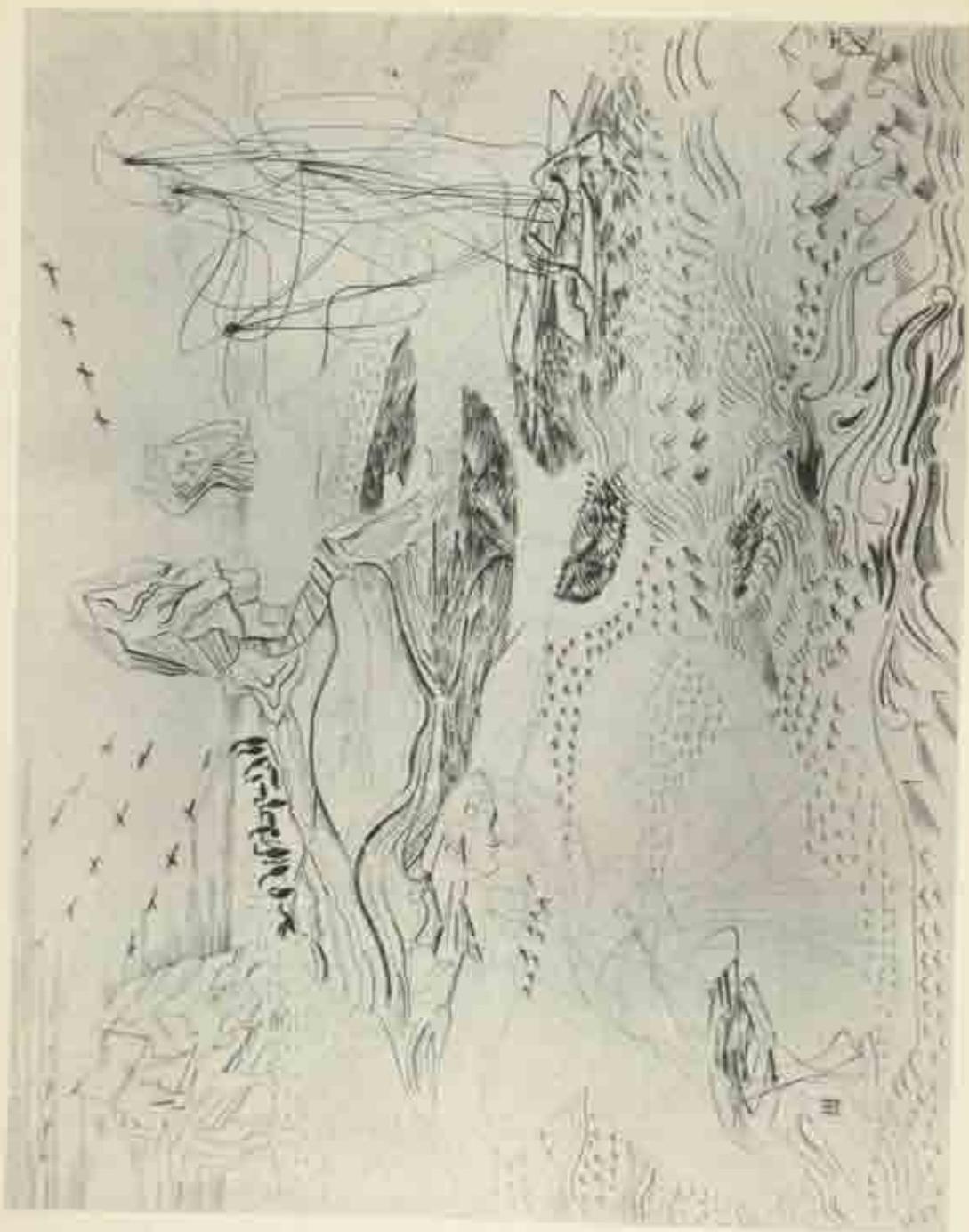
Fig. 99. Joseph Hecht (born 1891) and S. W. Hayter (born 1901): La Noyée, 1940, Engraving

successors, Louis Joseph Soulas (b. 1905) and, recently, Pierre Courtin (b. 1921), although still overpowered by the discipline of *hachures,* have made interesting works (Fig. 98).

Picasso had been working over the same period in a large number of techniques, from the dry points of about 1900 to experiments with bitten line aquatint, line through cracking grounds, and burin engraving in the cubist period. Later, when printing himself, he experimented with color superimposed on a sheet before taking the impression (Figs. 20, 26, 40). Although Paul Klee made few plates, they are all curious applications of etching (Fig. 107), as one would expect from his research in texture of paint and ink.

When I met Hecht in 1926 I was very strongly impressed with the latent possibilities of his manner of using a burin and later, realizing the necessity of collective work of a group in order to develop these and other possibilities, I set up a workshop where all equipment was available for artists who wished to work in those media. From dry point and burin line, aquatint, soft-ground etching used in the conventional fashion, members of the group (later known as Atelier 17), began to elaborate the methods described in the earlier part of this book. Printing on plaster was done from about 1930, Serge Brignoni, Nina Negri and John Ferren doing interesting work in this method. About 1933, it started to become clear that the use of the vivid line of the burin for the mechanical production of values in a plate was illogical, and the first impressions of textures on soft ground were made to produce a neutral surface when needed. The *collage* method of assembling different textures on a plate was employed brilliantly by Max Ernst, and later other uses of the method were found.

The hollowing of the plate to print white relief was suggested by nineteenth-century Japanese woodcuts, and was first used by us in 1933. Experimentation in color printing from a single plate by simultaneous relief and intaglio was started about 1931 and is still being developed.

The printing of metal cuts in relief for illustration was done in the early thirties, the method being an application of that practiced by William Blake. The plates were engraved or etched and later mounted type-high on wooden blocks, set up and printed along with the type. The method lends itself to illustration even on the most popular scale, as the cost to the publisher need not be greater than that of ordinary typography. Ian Hugo has illustrated several books by this means and two books

217

Fig. 100. Pablo Picasso (born 1881): Illustration for Georges Hugnet's
La Chèvre-Feuille, 1943. Engraving

of poems by Georges Hugnet, published under the most difficult circumstances in Paris during the German occupation, *Non Vouloir*, 1942, and *La Chèvre-Feuille*, 1943, were illustrated by Picasso using similar means (Fig. 100). The Picasso prints, however, were done by an extremely rapid method: an ink drawing was reproduced as a line cut, and then burin cuts (which print white) were made through the black masses represented by the original plate surface.

IMPLICATIONS OF GRAVURE
AS A SPECIFIC MEDIUM

CHAPTER

14

THEORY OF LINE

Expression of space

At one time it was customary to place spheres of mirror glass in the cages of birds, perhaps with the idea that looking into them would give the bird an illusion of unbounded space and liberty. When one looks into such a mirror, after an instant's adjustment, the sensation is rather that of looking outward than inward, into a space which, though showing increasing spherical aberration towards its limits, seems very similar to external space. One very obvious difference, however, is the distorted image of the observer in the center—not an observer present in the habitual conception of space. In other words the distinction between that part of space occupied by the observer and the "phenomenal world" around him is momentarily lost—at the expense of some degree of distortion. Although the space perceived is almost identical with external, egocentric space, the observer may for the moment have the illusion of being able to navigate in it outside of, or interpenetrating, his own body.

By reason of these two details—the loss of distinction between the outward and inward direction, and the completeness of the image (the observer being included together with the space observed)—the spherical mirror seems to me an excellent point of departure for the consideration of the space of the imagination and of its description by means of line.

The complexity of the human concept of space is demonstrated by the number of equivalent words that have had to be invented in all languages to characterize different aspects and functions of this idea. Physical space, that external space which is experienced directly through the senses, is complex enough. The senses of sight, touch and, to some extent, hearing are involved in its exploration; and one characteristic of the manner in which it is experienced immediately appears: without motion, in the sense of physical displacement in the medium, the experience of space is incomplete. Thus the recognition of space can be assimilated in this respect to movement itself—to the primary function of life. In the visual recognition of space from the scientific point of view it is found that where the dimensions of the space are not enormously greater than those of the observer a very slight change of position is sufficient to verify the relative distance of objects in space (a movement of the head, even a difference of angle between the axes of the eyes is sufficient to situate two objects if near enough). But when interplanetary distances are involved, a movement in the space itself becomes necessary before the space itself can be described to the observer (this is the phenomenon of parallax).

From this it appears that motion is inevitably involved with the concept of space—motion either of objects situated in space or, on a smaller scale, of the observer. I wish to concentrate on the concept of space rather than on space as a thing, since the concept, being referable to human habits of thought, is more easily verifiable than space itself, and thus might be considered to belong to a higher order of reality (see Introduction).

We have noted that for the recognition of certain dimensions of space the existence in the space of objects is also necessary. One view of concrete objects in space is that they can be considered as modifications of the space which interpenetrates them (the ether of the scientist)—modifications in respect to mass, rigidity, or fluidity, or in fact of objectivity. In many cases it is the properties of such modified fractions of space—

224

Fig. 101. S. W. Hayter: Combat. 1936. Engraving with Soft-Ground Etching

their capacity for emitting or reflecting light, heat, sound or other vibrations—which constitute the only means of observing or experiencing the space in which they are situated.

In a sense one could say that the mathematicians have explored the space of the imagination with which the artist deals. Expressions arrived at often for quite other motives can be considered as referable to space, in some cases even reprojected in concrete form to make models illustrating curious properties of line, surface, movement in space. Of course it is possible to translate the indices of x, x^2, x^3, as length, length $\times$ breadth, length $\times$ breadth $\times$ height, as their usual terms square and cube indicate; but when one attempts to visualize the square root, or the cube root of x, or to follow completely reasonable operations with negative quantities, or with the square root of -1 except when employed as a versor, the difficulty of translating the dialect of mathematics into visual expression becomes obvious. In other words, if the mathematician has explored the space of the imagination he has not carried a camera and the recording of his comptometer gives us nothing but quantities in another species. One important characteristic shown by the analogy with mathematical space is that it is not limited by duration; the time factor with which it is inevitably associated can be imagined to travel forward or backward with the change of a sign, and is not unidirectional as it is in external sensory experience. The ambiguity between the inward and outward sense can be demonstrated by the number of solutions to a problem in the mathematics of space, some of which may be "real," others unreal or, rather, unreasonable, some negative and others positive in sign—yet from mathematical considerations there is exactly no more reason to favor one of the alternatives than another. In fact the commentary that mathematics furnishes on the problems of space, though reasonable (meaning in step with general human habits of thought) and consistent with itself, omits most of the functions of space which are of interest to the artist, just as a sine curve fails to induce all the emotional reactions of a ride on a roller coaster.

The visible space seen in the spherical mirror is completed by the space occupied by the observer himself, but the space of the imagination is *not* limited by the restricted experience of the individual in his own lifetime. In the unconscious mind one might expect to find traces of the experience of space derived from other species from which man has evolved, such as the freedom of movement in three dimensions in water

226

reconquered, in some respects, by the conquest of the air. The space of the imagination, like that of the mathematician, is not limited in direc-
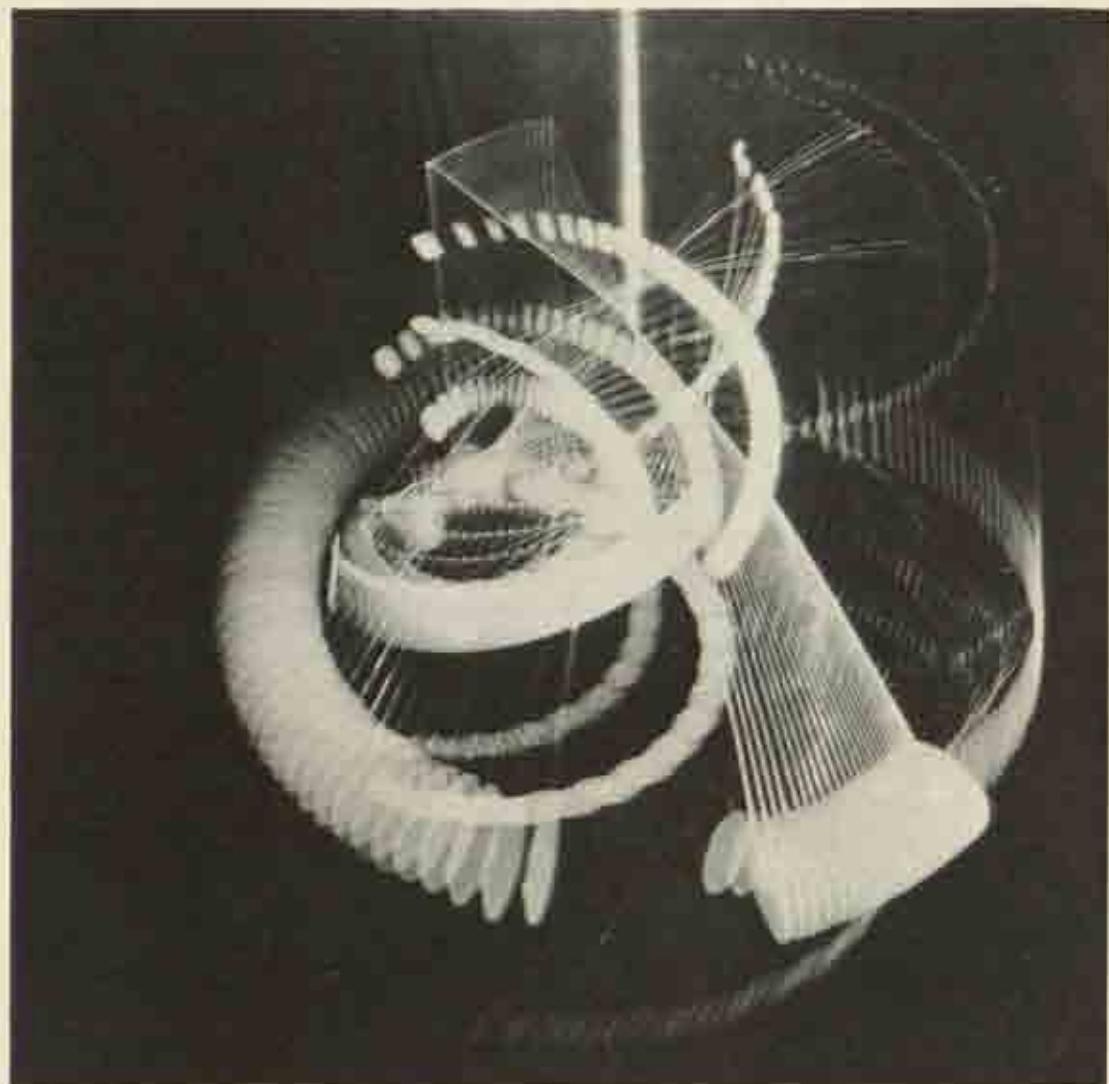

Fig. 102. Alexander Calder: Hanging Mobile, 1936. Aluminum
and Steel Wire

tion or duration in time, nor is it inevitably confined to one order of time; the simultaneous realization of a number of rates of movement in time is quite possible. Space can travel forward or backward in time as

it can travel inward or outward, or both, or into an unlimited series of dimensions. The movement of space, and the motion of objects in it, have less limitation and their representation greater possibilities than such phenomena in external space. Thus the space of the imagination contains an essential mutation and ambiguity—that order of ambiguity that permits the poet to imply an infinite series of linked consequences in a single phrase and a score of experiences to be simultaneously present to the mind of a child.

The line

For a generation both sculptors and graphic artists have shown an intense preoccupation with the interpretation of imaginary space. They have not been alone, for in consequence of the increased technical means of action in space and time, the whole world has developed the same interest. They have operated with concrete construction, employing actual motion, density, equilibrium and color; but for the moment I wish to deal only with one particular means of description of space—line.

What is a line? If one asked this question of a thousand people surely none of them would hesitate to reply, but it is very probable that the replies would be as various as the individuals who made them.

The word in everyday speech may mean *outline;* a trace describing a margin, a limiting edge, a boundary of an area or a solid, an encompassing trace, a fence, and, by an obvious extension, a bond, a lien, even a link. A base line is a conversion of this idea to the purpose of measurement, a step in triangulation. A dividing line is an application of this category to separating the parts within a whole, a zone, a meridian, an azimuth, or lines of latitude and longitude; these are dividing lines applied to the surface of a sphere or to space.

A *plumb line*, however, is something different; it is a thread whose use is to plumb, to explore as well as to measure; and as a line it is the representation of a gravitational pull. Of such lines, the catenary curve of the chain suspended from two points, the parallelogram of forces, are extensions. In the case of the fishing line, the hand line, the life line, the cordage of a boat, the line is a strand, cord, or hawser without inevitable association with a force.

A *pipe line* is obviously a tube along which a liquid can be transferred; a railway line, a trace representing possible conveyance of passengers or goods; a line of steamers, an imaginary trace along which

boats either have passed, or can be expected to pass. Thus a great number of such common uses of the word involve the existence of a path, a locus, the record of actual or potential displacement of some object in space. A line of fire, the trajectory of a bullet, an orbit, the path of a comet, are simpler versions of this sense of line.

By dictionary definition a line is a long narrow volume of a color or value differing from that of the surface on which it is traced. Its function in expression however may be to represent:

(a) A long, narrow object, as a strand or thread, stretched, bent or laid on a flat surface; e.g., a limp thread.

(b) A wire or more or less rigid strip seen edge-on, bent or twisted in three dimensions, or in a two-dimensional plane not parallel to the plane on which the line is drawn; e.g., a coiled spring.

The distinction between these two categories is, in addition to the three-dimensional character, the quality of resilience and comparative rigidity represented by (b).

(c) As the defining edge of a plane against another plane, a volume against another or against space. These functions of the line are of course quite arbitrary, as that which is represented is in no sense a line.

(d) As in many mathematical diagrams, the locus (path showing successive positions) of displacement of a point or an object in motion. Here again the representation may attempt to indicate a two-dimensional path or one in three dimensions.

(e) A direction of movement, or the direction in which a force or tension is exercised without any implied point or object in motion. Again used in mathematical illustration of mechanical problems.

(f) As in the original definition, a long narrow volume which may dilute to a volume of different character or may diminish to a series of isolated points.

(g) In combination with other lines, parallel or hatched, to describe a difference of value or illumination.

(h) A mesh or web of filaments or fibers as in a membrane, or a net which itself, with its torsions, inversions and movements, can describe a surface in space.

(i) The axes of volumes; or the axes in space serving to situate objects by the relations of such objects to them (co-ordinates).

When we employ such expressions as a line of action, a line of development, a musical line, we are no longer referring to a displacement

in space alone; the narrative sense of a displacement in time is involved. Even in many of those cases already quoted in which a force or a velocity is assumed, the factor of space divided by time is implied in the trace. To see how the notion of line acquired such universal significance we might try to follow its original inception.
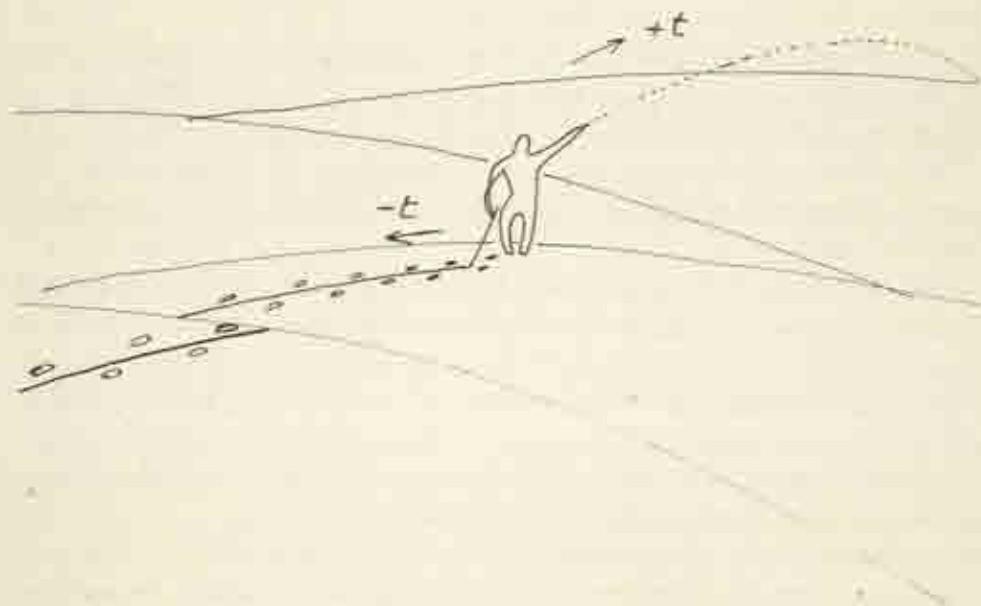
Fig. 103. Origin of Line

If we try to imagine the first instance in which any being recognizable as man made use of the concept of line, two gestures offer themselves with about the same degree of probability. Either our savage ancestor observed the trace of his passage on a sand or mud surface, looking backward from the point at which he had arrived, or from his position he pointed in a direction in which he proposed to go, to send someone, or something (Fig. 103). That aspect of the notion which interests us is, of course, its employment for the purpose of communication.

To drive or pull an object across a surface to record such an experi-

230

ence and to use the result to transmit it to another is an action which seems so obvious that we should expect to find it side by side with the earliest traces of human activity. The forces employed are of the simplest and the incentive is clear; but even at this stage the line shows all the characteristics of a convention, a symbolization: the representation of one thing by another rather than the quality of direct imitation. The trail or trace which the individual has drawn behind him in our first instance, though readily symbolized by a long, narrow mark, really is not entirely representative of what happened, as a number tells us only how many, and not what kind of, objects we are counting. Actually we could say that a discontinuous record of displacements with variable intervals of time between them is recorded by only one of its qualities—its direction.

This record could be taken as the description of past achievement such as the railway line where trains had passed, or the unraveled clew of Ariadne which could permit the repetition of the act already performed. In this sense the point to which this order of line tends and from which the second order of line issues, the standpoint of the reflective anthropoid at the moment of his discovery of line, is the peculiar present in an unidirectional time system. Now all of the pointing sort of lines issue from this point in time; they project, advance into the future, and as the point itself can be assumed to move, such lines must be considered to travel ahead of the movement of the individual experiencing them.

Once the line has been traced the imagination is freed from the time limitation inherent in the two different conceptions involved in its execution, although it remains to be seen whether in the trace made by a different means some implications of the conditions of execution do not remain. From the plan which the line represents or the project of movement it describes it becomes easy to retrace it from the limit of futurity back to any assumed present, or to more than one assumed present—to travel backwards in time as readily as one could retrace in space the same directions. At this point the imaginative domination of space and time by the elementary gesture of tracing a line, with its consequent liberation, becomes obvious.

If we imagine that this primitive line of experience were elaborated into a record of sufficient completeness to give a map of those means of communication available in a limited terrain, and that projected lines

like the north-south indications in the margin of a map, could be made (of the second order of line mentioned), then it is conceivable that primitive man would be led to orient himself in whatever position or direction he might desire by means of his chart (or, let us say, his drawing) and thus achieve from its use a very practical degree of convenience in circulating in that terrain. As we are occupied with the de-
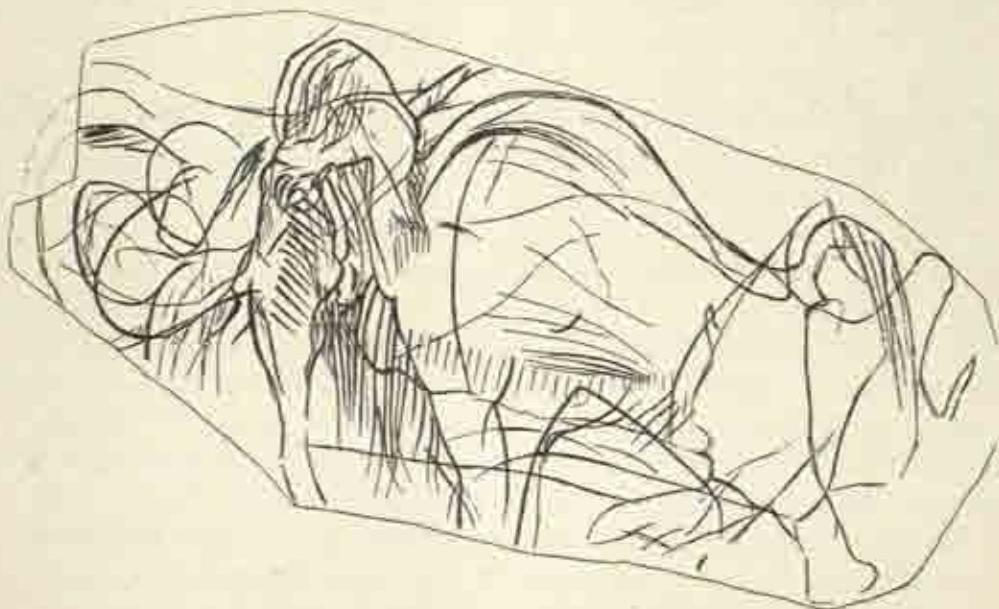
Fig. 104. Dordogne (France): Mammoth. Prehistoric Rock Engraving

velopment of the concept of line rather than the acutal moment at which a particular use of it was current, it is not important that a considerable interval of time must have elapsed between the first trace and its elaboration into a chart.

In the phenomenal world around him prehistoric man could observe relatively few examples of true line to imitate except those he made himself with such ease. Sometimes a crack could be narrow enough and long enough; a twig, a vine, a thread, or a fiber again could be long enough for its thickness to be negligible. Perhaps the lightning—the luminous trace of an electrical discharge—would be the purest example of true line in his experience.

But in examples of prehistoric art from the earliest times we find two different adaptations from the function of line as a line. In the representational form volume is described and silhouette, itself not a line, delineated by the same trace. In fact, in this type of drawing, all the lines could be said to be descriptive of things not in themselves linear (Fig. 104). It has been suggested by archaeologists that the purpose of these images was of the nature of imitative magic, that primitive man made such drawings to obtain power over the objects he represented.

Another application of line which seems to have arisen at the same time and to have developed alongside the representational form, is that lamely referred to as geometrical or decorative. The latter term indicates that the use of the lines is solely to enrich the surface on which they exist. I believe, however, that in many cases the interest of the artist was clearly in lines as lines; perhaps their significance to him mirrored the magical power that the concept of line gave him over space and experience. Lines have had such a function, even geometrical lines, in occult ritual of historic times. And it is important for our purpose to note that the linear forms used in this sense are not conversions of line to the imitation of objects, and thus have a sense different from that of those employed in imitative magic.

From these two directions in the prehistoric use of line, the development of representational drawing and of line for its inherent significance, their adaptation to hieroglyphic, symbol, syllable and cypher does not seem abnormal. In fact, as with the perfection of many human means of communication, one feels that none of these steps demanded the boldness of imagination required of the first man who represented a world of light, of shadow, of space and volume and time with the same universal convention of line.

To leave for a moment the significance of the line when made, two orders of line have been described, distinguished from one another by a fundamental difference of attitude in the artist to their direction at the moment of their creation. Although lines made in both of these ways can finally be referred to the numerous functions which have been found for line, it is important to realize that at no point does any line completely lose any one of its original or acquired implications, though one or another may be emphasized at the expense of others.

Although certain of these functions of the line in expression are less

familiar than others, all of them are used and are to be used by the artist. They are not mutually exclusive. In the process of tracing a web of lines to indicate a transparent surface which diminishes to a point or fold, the accumulation of the lines will give a difference of value suggesting an effect of light; the character of curvature of the individual lines composing the mesh will itself suggest rigidity, resilience or tenuity; the tensions existing at the intersections of lines of unequal force may be modified by other intersections or by the addition of a point at the intersection. A single line which at one point of its trace represents an object may continue to describe the margin of a plane and may divide into a system of lines to indicate a transparent surface. A number of lines which describe movements in three dimensions will still intercept areas between them in the plane of the drawing, the effect of which will be perceived simultaneously with that aimed at with the individual lines.

Where two lines are drawn to converge to a point it is entirely reasonable to imagine them to represent parallel traces upon a plane or curved surface not parallel to the plane upon which they are drawn—the familiar experience of perspective will easily cause the point to appear more distant than the open ends of the lines. But by concentrating a moment on such an image it becomes equally reasonable to suppose the point of intersection to project in front of the plane of the drawing; in fact we find immediately that the character of the space of the imagination is clearly demonstrated by the ambiguity of significance of the two lines.

In line engraving, as in sculpture, the trace does not remain precisely in the plane of the plate (consequently of the print made from it) although in engraving the departure from that plane may be only of the order of a few hundredths of an inch at its maximum. As the burin cuts into the copper, the deeper cut will be separated in space from the shallower and finer cut, so that the possibility of concrete construction of space exists (Fig. 18). When printed, the deeper cut will give a line which is physically higher in relief above the surface of the paper than the finer cut; and it would appear that in this manner all that was intended to be closer to the plane of the image could be made in stronger relief, and all that should be more remote, in lower relief. However, in seeming appearance, the difference in plane between lines of higher relief and lines of lower relief can produce the

234
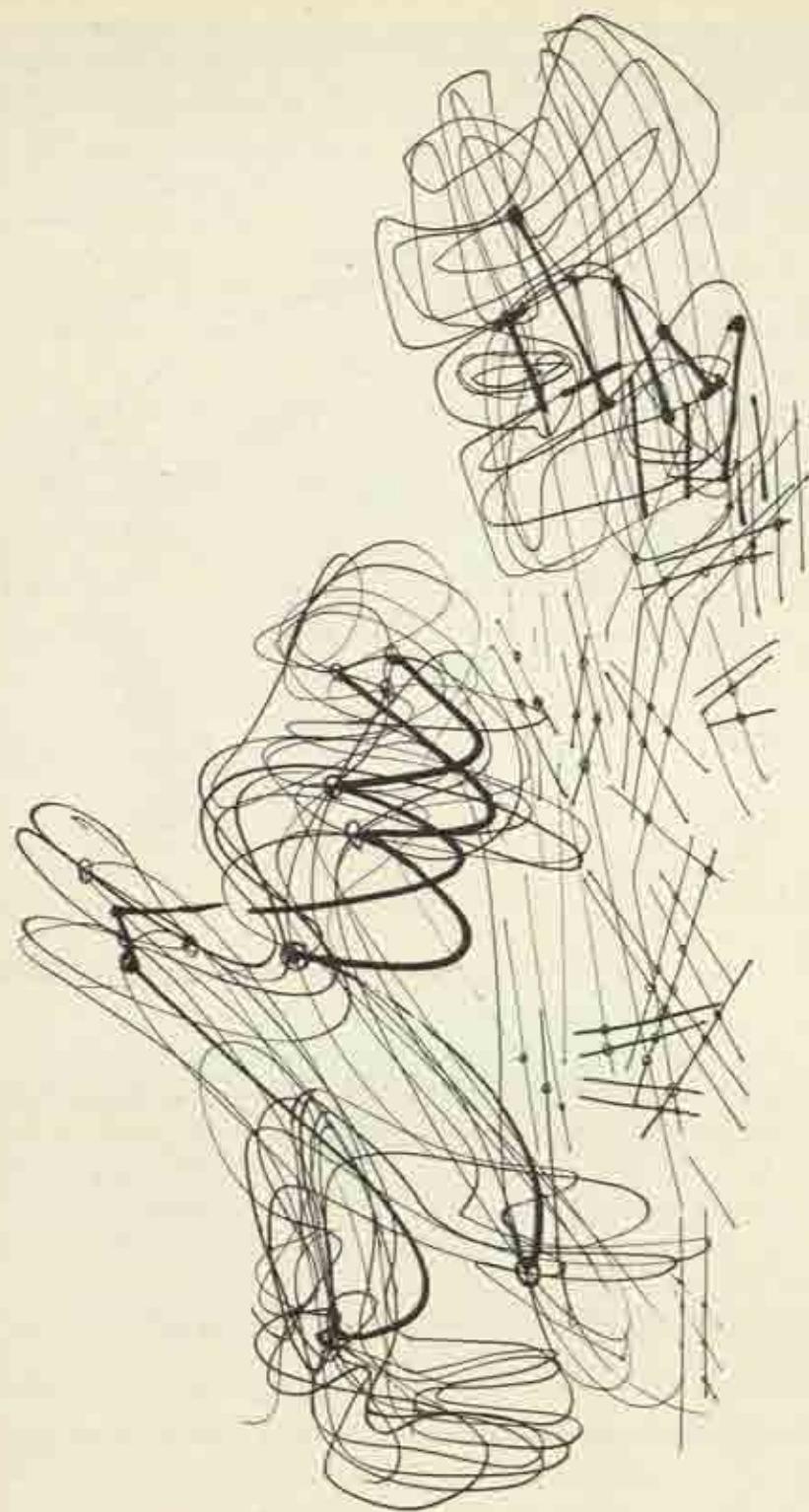
Fig. 105. Different Kinds of Line
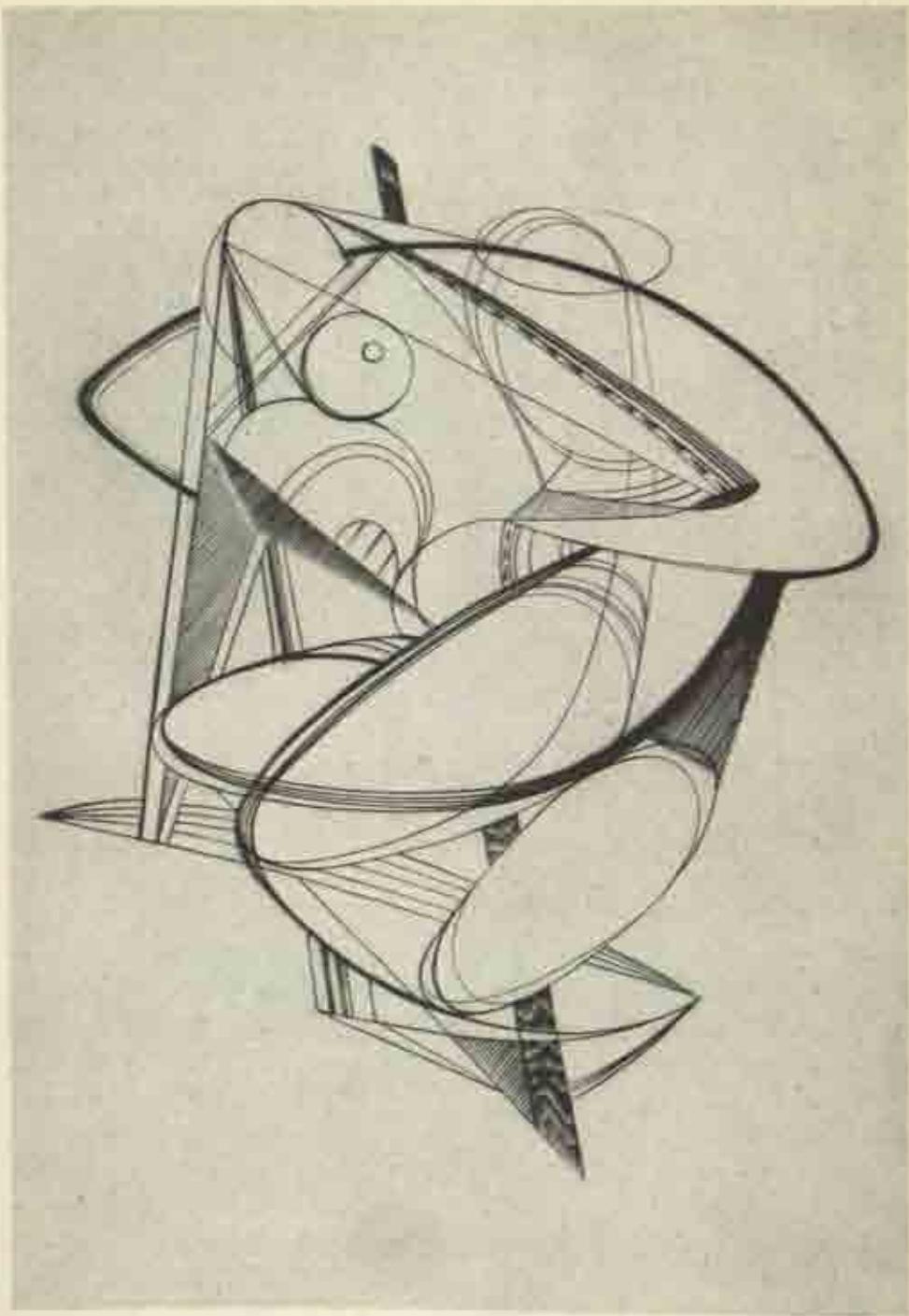
Fig. 106. John Buckland Wright: Nymphe Surprise II, 1936. Engraving
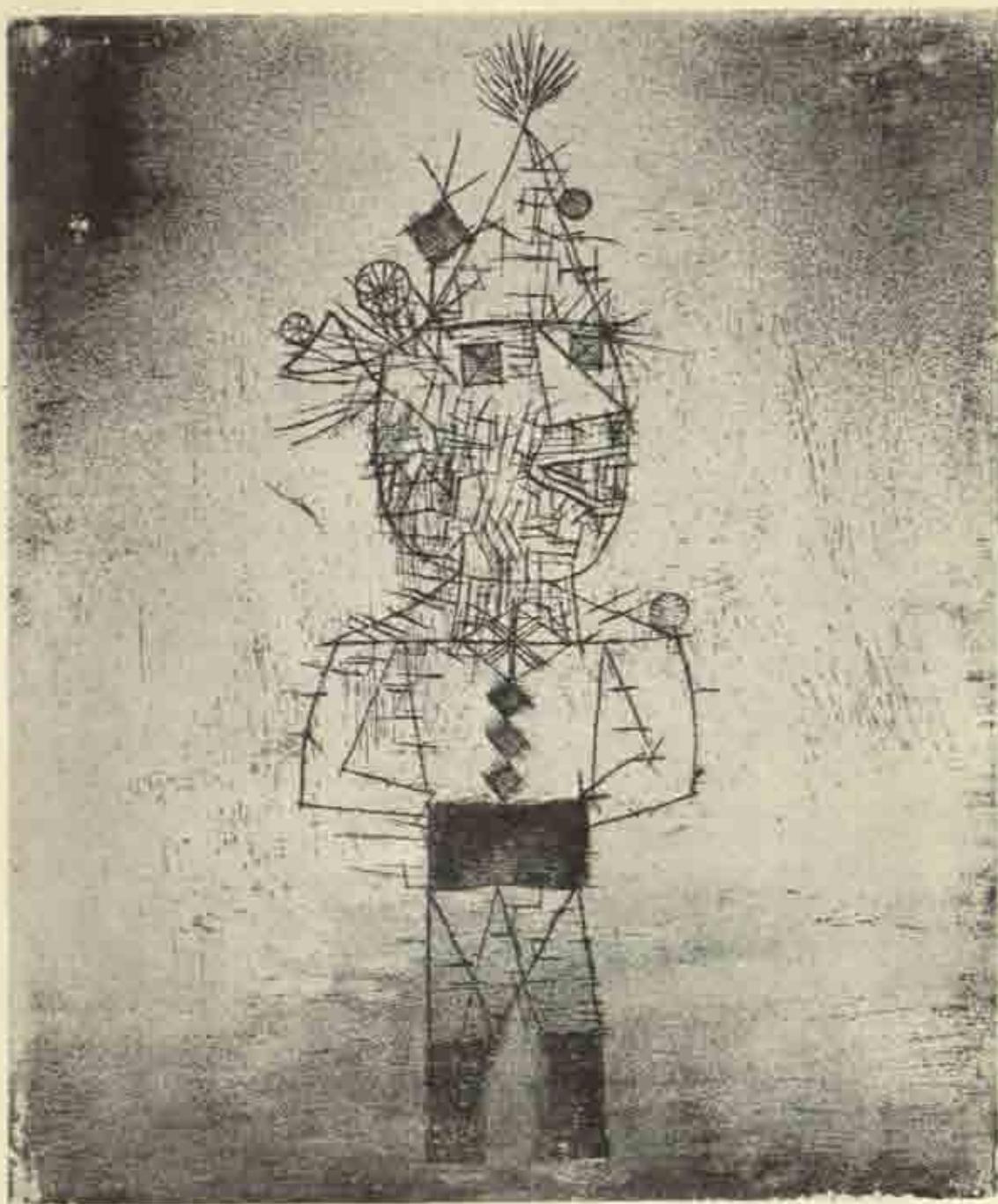
Fig. 107. Paul Klee: Prickle the Clown, 1931. Etching

opposite effect, as very little experience will show. What is physically in front (that is, lines in higher relief), can actually appear to recede beyond what is physically behind (the lines in lower relief). It should be noted that such an effect differs entirely from the effect achieved by the use of the conventional means of indicating perspective, which convey an illusion of distance by employing converging lines in a flat plane simulating parallels in another plane, or by modulating the color to suggest the increasing density of atmosphere. The difference between the two effects is one of kind, not of degree. It is the difference between apprehending an event by actually witnessing it oneself, and apprehending it by a deduction from someone else's account. Whereas the use of the conventions of perspective presents only the evidence by means of which a rational deduction concerning the nature of space can be made, the use of a concrete, physical means, such as a distinction in plane between high and low reliefs, conveys an apprehension of space as an immediate sensuous experience, depending on a change in scale only, as when a man's figure is shown an inch high, yet is instantly recognized as the image of an object known to be larger.

So we find that line, having in its function the same essential ambiguity as the image in the spherical mirror, gives us an enormous positive advantage in the description of the space of the imagination, not by reason of its lucidity alone but also because of its possibilities of expressive ambiguity.

It is obvious at a glance that lines, such as skaters may trace on ice, or the trajectory a tracer shell describes in the air, have a quality along their length which is different from that of lines executed entirely within the control of the hand at a distance from the eye—different, because of the physical participation of that which creates the line in the motion it described. Yet once the trace has been observed, if from some aspect the intervals between the trajectory and other objects should happen to constitute a local resemblance to any of the other applications of line by human agency, to graphic, hieroglyphic, representational, imitative forms present in the human memory, then all of these possibilities will immediately associate themselves with the experience of the observer.

Paul Klee, who has investigated the qualities of line perhaps more extensively than any other modern artist, says, "the eye follows the paths prepared for it by the creation." Line, in his sense, is then a path: but the

238

path is prepared by the "creation," by the activity of the imagination. I am convinced that even those artists who imagine that they are drawing from life, who imagine themselves to be transferring the retinal image of the edge of a volume to paper—even if such a deliberate sterilization of the function of line were desirable—do not in fact do this. I suspect that, even in such obstinate devotees of the immediate visual image, during the few seconds that elapse while the focus of the eye shifts from the remote object to the surface of the paper, a concept has been formed in the mind. Perhaps this is modified by a conscious or unconscious remembrance of similar objects—and that which is described on the paper is the concept and not the literal image before the artist.

CHAPTER

15

DESCRIPTIVE DRAWING - EQUIVALENTS OF COLOR AND VALUE AS IN PAINTING

From what has been said in the last chapter it should be clear that more is implied by drawing than the very common notion that it has no wider function than graphic (that is, linear or tonal) description of an immediate visual image. Yet even within the limitations of descriptive drawing there are resources in the engraving and etching media which are not fully realized. Our conclusions about line will be directly applicable to the linear techniques where they are seen with greater precision, and applied with greater severity, than in drawing as such. At the same time the methods of engraving have been consciously or unconsciously applied to drawing by artists since the sixteenth century.

Where a line is employed to describe the silhouette of a volume there are three quite different consequences to be expected. The diagram (Fig. 108) shows three silhouettes (A, B, C) in which the same means is used—a continuous trace becoming heavier or lighter. The logic of the first (A) is obvious; apparent modeling in light and shade is indicated by a thickening of the line in shadow. It is almost like a written

240
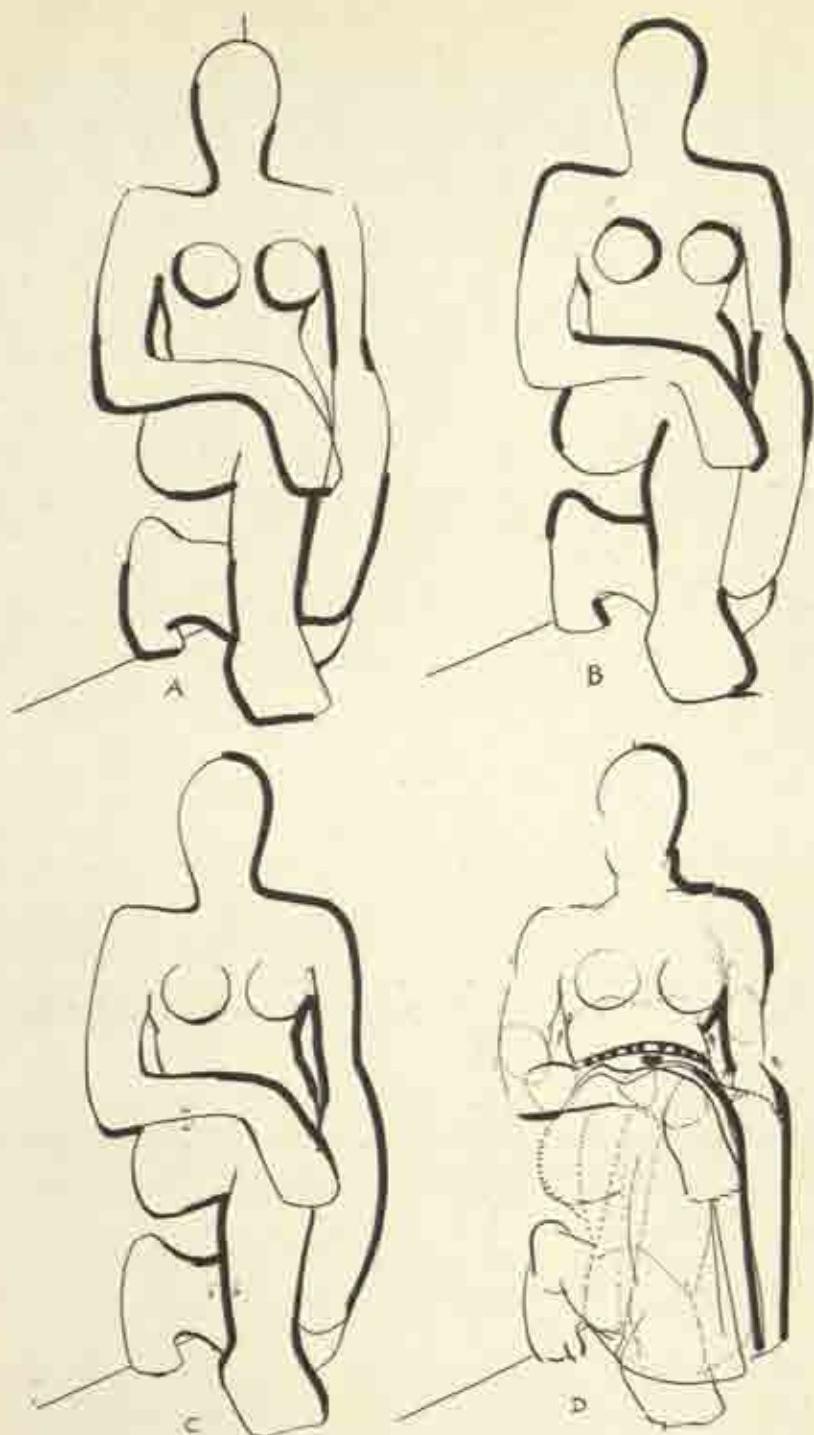
Fig. 108. Effect of a Profile on Volume and Space
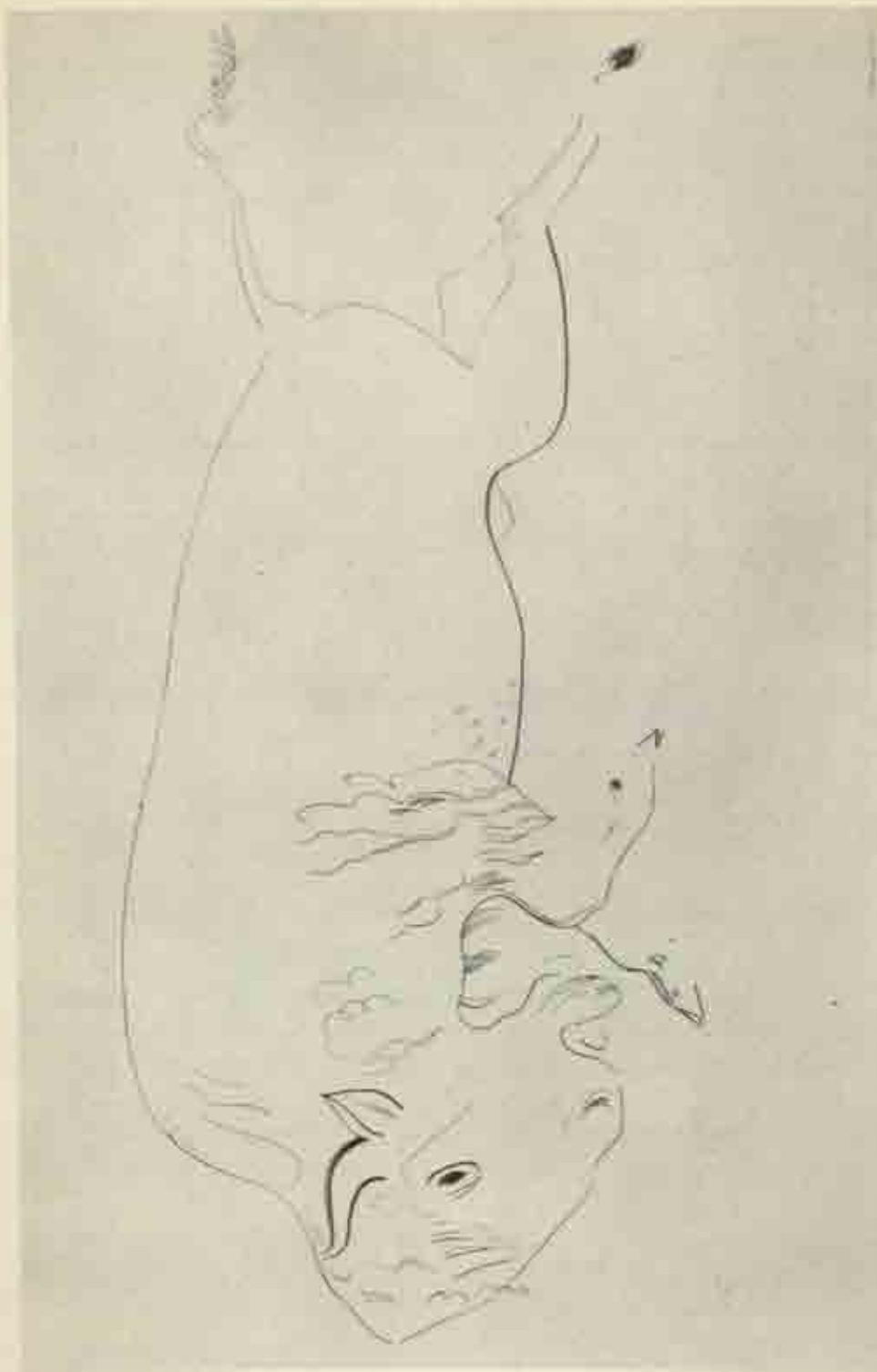
Fig. 109. Joseph Hecht: Bison, c. 1930. Engraving

description of what happens. The second (B) follows a similar logic, but in reverse, that is, the apparent high lights in the volume are shown by contrast against the heavier line. Concentration on this diagram for one minute should, I think, prove them quite visible. One could call this an optical device. It is also interesting to note that in the second example the line is a part of the background assumed, and not actually part of the figure represented. Now in the third (C), the variation of strength of line is not to be explained in either of these two manners— let us consider what the effect really is by making a few comparisons. What is the apparent distance between a and a'? I think it is clear that it is small. The apparent distance between b and b' however is obviously greater and the recession is produced by the heavier line only. This device could be called *consequent* as it depends on a conclusion of the observer.

I would suggest at this point that the consistent employment of any one of these devices is very tedious in effect. If we take Hecht's line engraving *Bison* (Fig. 109), traces of all three devices are to be found, and their use must have been instinctive. This is however no plea for ignorance: the artist who has become entirely familiar with these consequences to a point at which they can be forgotten, has acquired the power to apply them with greater effect.

For this demonstration the line has been made continuous; interruptions and bifurcations were eliminated to present the case as simply as possible. But, when we follow more closely the use of line for the purpose of describing volume, we see that an interruption can demonstrate real disappearance of a profile against a background of exactly the same value, the disappearance of a volume in depth (when it is seen as a visible part of an uninterrupted trace which rejoins the other profile), or, as with dotted line, a change in the texture of the surface (Fig. 108D). The arrows show in which direction the overlapping volumes appear to turn. Owing to the exaggerated intensity of the engraved line, all of these consequences which have their function in drawing will have greater importance in the print.

In drawing, one of the methods of indicating change of lighting, of modeling, of position in depth, is a contrast of tone; and hatching, shading, and the massing of lines are very usual means of obtaining this contrast. When we compare the use of the same means in etching and engraving we find again that the control over them is much more
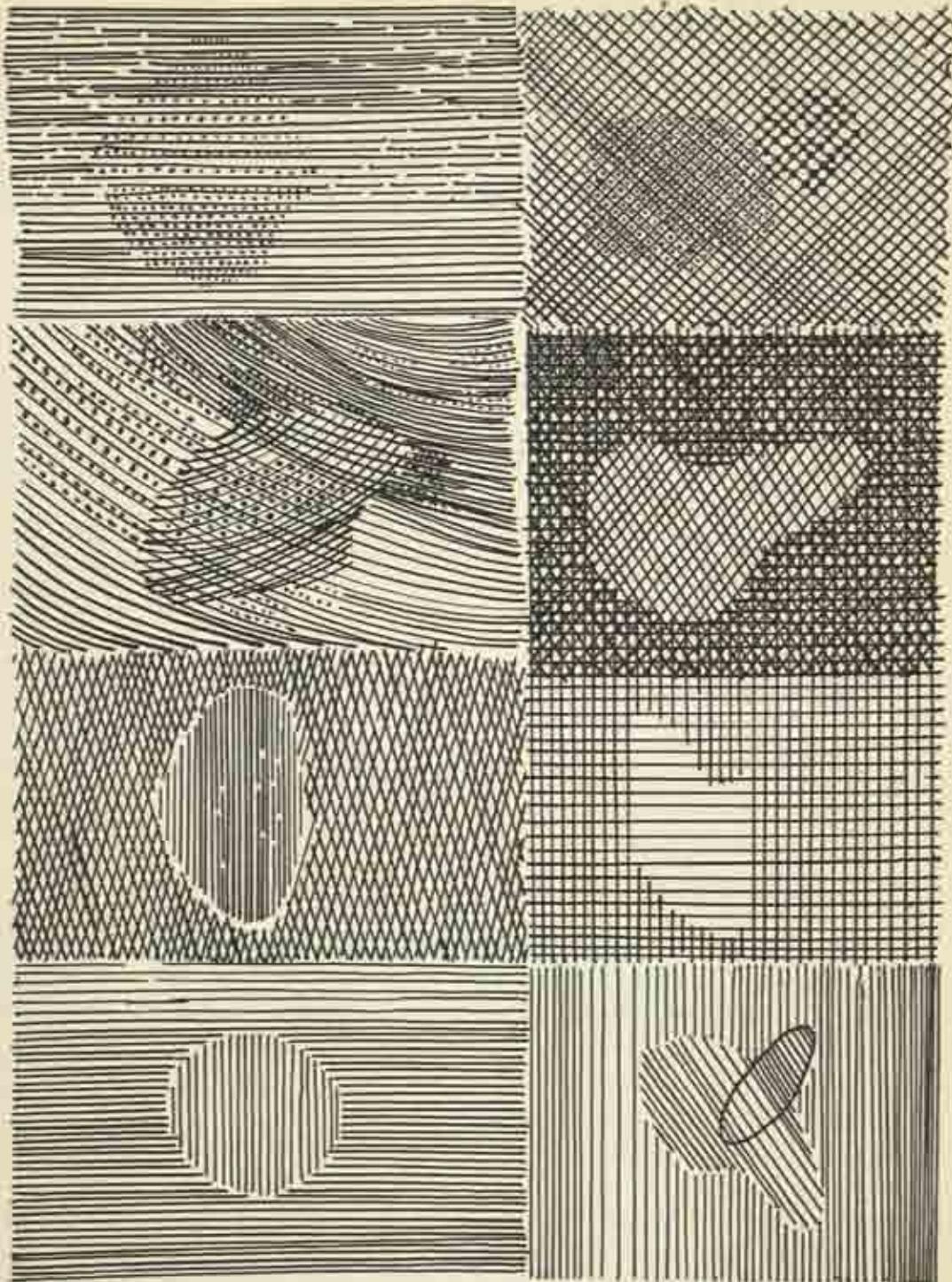
Fig. 110. Equivalents of Color Achieved by Hatching

severe, and that the slightest variation in direction has great effect. Observation will convince most observers that, as a result, the fewest directions needed to produce the result will give the strongest effect, and that a change of direction in shading will be effective only if absolutely necessary to the expression of the design. This necessity in interpretative gravure may be conditioned by texture, volume, light value, or color equivalent.

The quality of color in painting, with the powerful means of expression that it constitutes, has no direct application in etching, if we except prints in color in which the limitations of monochrome are not accepted; these, however, form a separate subject, more closely allied to painting. In this chapter it is the equivalents of color in black and white, or in one color (ink) against another (paper) which interest us particularly. The two functions of color that we shall study are: variation of hue, and indication of space by opposition of color.

It is obvious that, as in the parallel shading of earlier reproduction engravings, cross-hatching in two or more directions will indicate a contrast comparable to that between warm and cold color. In general shading, in which strong lines are laid horizontally, particularly if sufficiently spaced to count as lines, these will give a maximum effect of cold color as blue or blue-green. Where this principle is applied to small elements seen against others of similar dimension, the horizontal will correspond to lines parallel to the longest axis of the volume rather than to the horizontal direction. Vertical parallels still give a cold effect, less marked than the horizontal, diagonals even less; in fact, the latter will only appear to be cold if contrasted with cross-hatching. Where the lines are closer-set or finer, the effect is similar but less marked, and tends toward a more neutral tint; where the lines are close enough and fine enough to be no longer readily distinguishable as lines, the effect becomes almost neutral. The white dots which result from interruptions in such systems of lines are of great interest (Fig. 110).

Cross-hatching in two or more directions gives a tone which becomes definitely warmer as more directions are employed; also the effect is warmer when the angles between the components approach the right angle. Again the color effect approaches neutral as the lines become finer and more closely set.

Curved lines used as parallels or cross-hatched are in their effect

similar to straight-line systems, except that they tend to be warmer as if in a lower key. Dotting with flick dashes in burin work gives a more or less neutral effect as the total approaches a line passage, being generally rather warm than cold. The triangular dots of the burin, with burr removed, if set close enough to give a tone, give a warm effect; if smaller and closer set, a neutral one. The round dots of burin or *criblé* give neutral to warm effects if seen against the characteristic parallel shading. Burr left on burin work, or dry point, reduces these effects; that is to say, warm tones appear less warm and cold tones less cold, rather as if mixed with a neutral tint. Combinations of dotting and line generally follow the character of the line element, again in a lower key, as if diluted with neutral tint.

Bitten textures described in Chapter 5 may be used in etching to replace the resource of color opposition in painting to distinguish areas of similar value. They may give a cold or warm effect if definite cross-graining of striation exists in them. Open and deeply bitten parts will appear colder than those closer and more lightly etched. Again in transferring a texture to be bitten, if it is applied with greater pressure to the ground the effect will be warmer than if pressure is less. The open bitten-out areas described will, of course, be warmer still—approaching the tone of dry point. The close regular grain of resin-ground aquatint is rather neutral; it can be varied by previously executed line work seen through it, and it appears warmer when the texture becomes coarser as in sand grain (Fig. 111).

All these considerations apply more directly to reproduction where a colored design is being translated into the terms of engraving or etching. In practice the use of such textures is applied in a much more arbitrary fashion, the difference of quality sought for depending more on a distinction between active and neutral surfaces. By an active surface is meant a texture in which the difference of value of the components is at its maximum, a neutral surface is one in which the difference of value of the components is very slight. It is obvious that unless line, construction or composition contribute to destroy the effect, the former type of surface will appear in front of the latter. Similarly in the matter of value, in which engraving and etching have much the same resources as painting, the normal regression in three-dimensional space represented with uniform illumination from above will be from the greatest possible contrast of light and shade in the foreground to

246
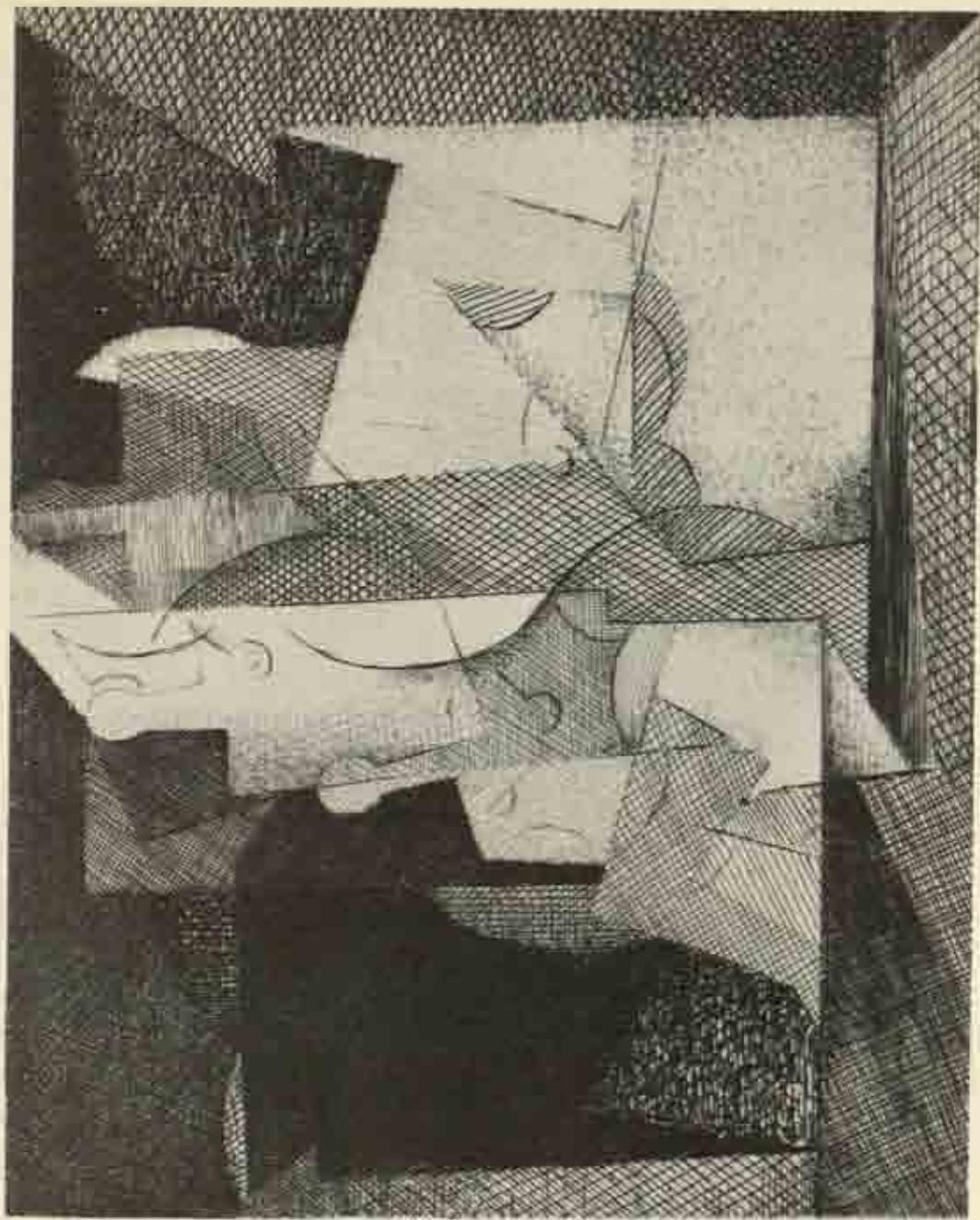
Fig. 111 Louis Marcoussis: Plate from *Planches de Salut*, 1931. Etching and Engraving

a lesser degree of contrast in the middle distance; in the extreme distance differences of value practically disappear by the progressive lightening of shadow and darkening of illuminated surface through atmospheric absorption. Thus the typical representation of a plane receding from the observer will show a value becoming progressively darker from light to a half-tone at its further limit, owing to atmos-
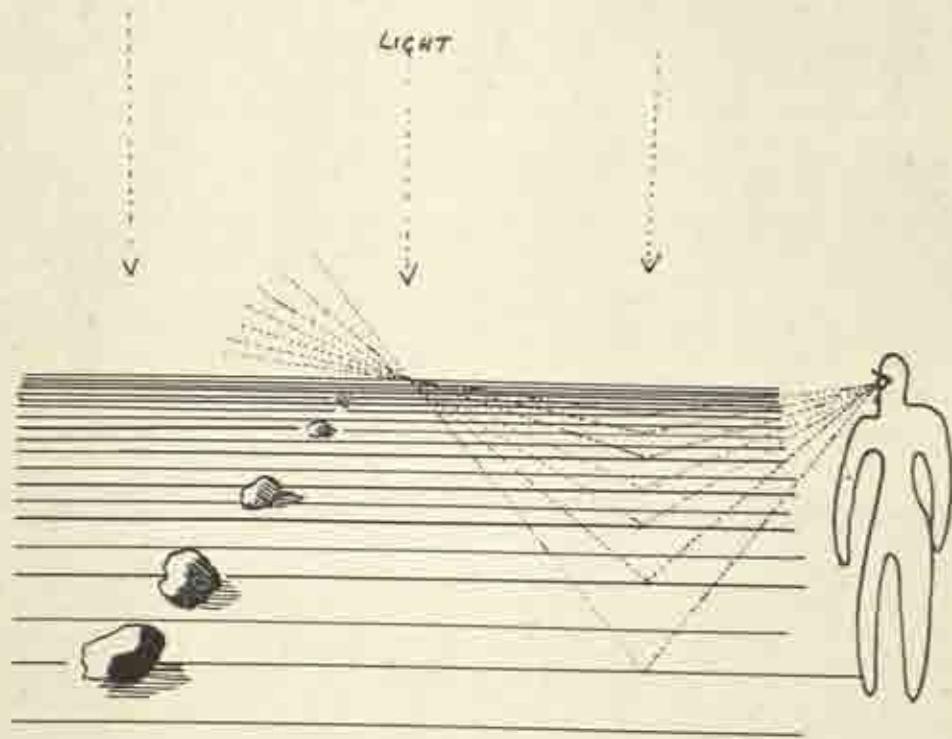
Fig. 112. Receding Plane

pheric absorption and the increasingly flattened angle of the reflected light as it arrives at the eye (Fig. 112). But on such a surface the object in relief will throw the most definite shadow in the foreground, and less as it becomes more remote, until at a certain distance light and shadow become indistinguishable. Thus in the characteristic ground plan of the *Horse* (Fig. 113) the general value becomes darker toward the horizon. The lines and dots that express folds or variations in it, however, are heavier in the foreground and become lighter as they recede, hence must be more closely set to obtain the darker general value.

248
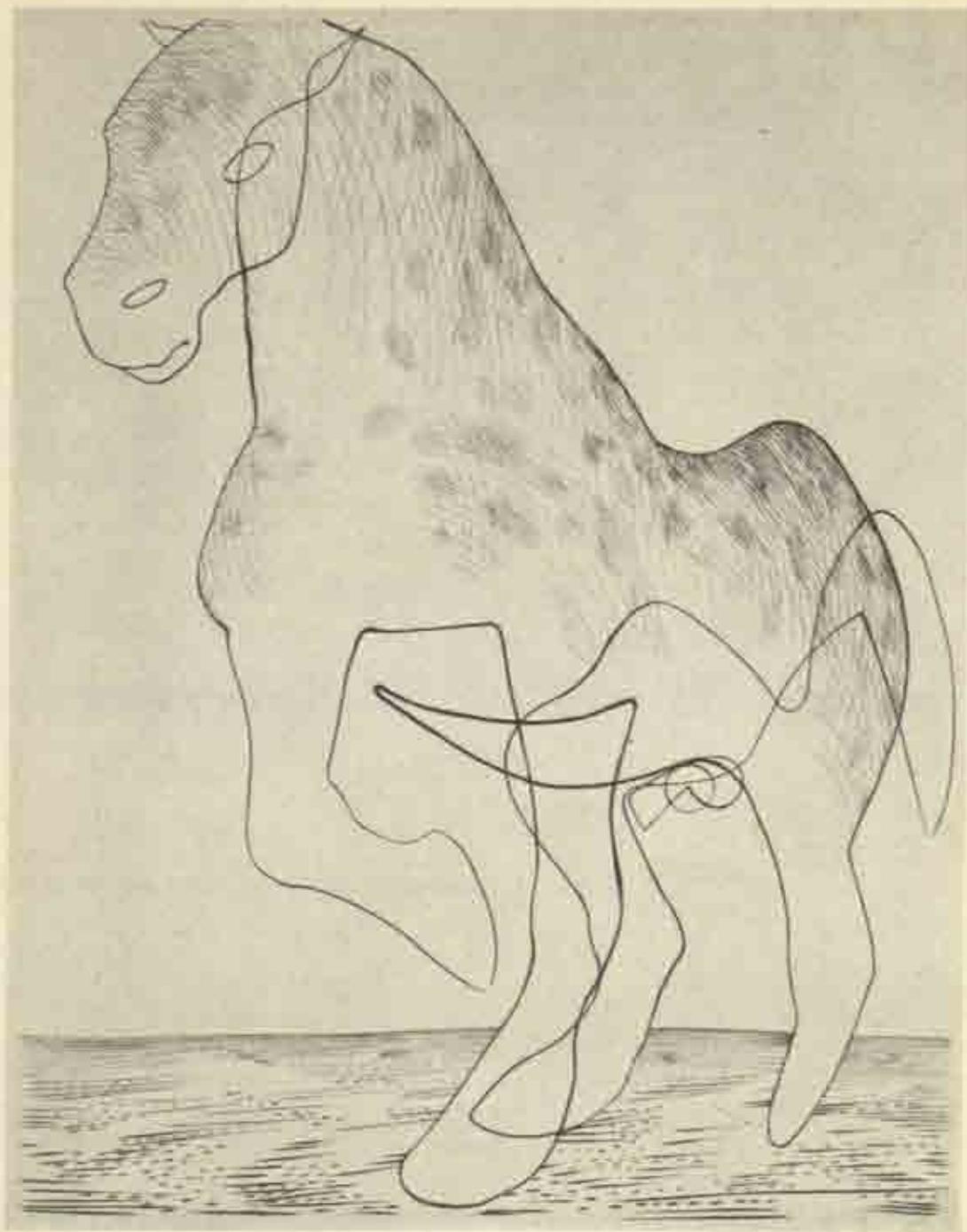
Fig. 113. S. W. Hayter: The Big Horse, 1931. Engraving

Any other succession would give the plane a sensation of flatness in the surface of the print, of reversal of direction with regard to the observer, or of transparency.

Thus in the simplest representation of a water surface two components exist. One is represented by the reflection from the surface at an angle of view too acute to allow the observer to see through it (less than the "critical" angle for water). Under these circumstances the plane follows the same rule as that already described, i.e., light fore-
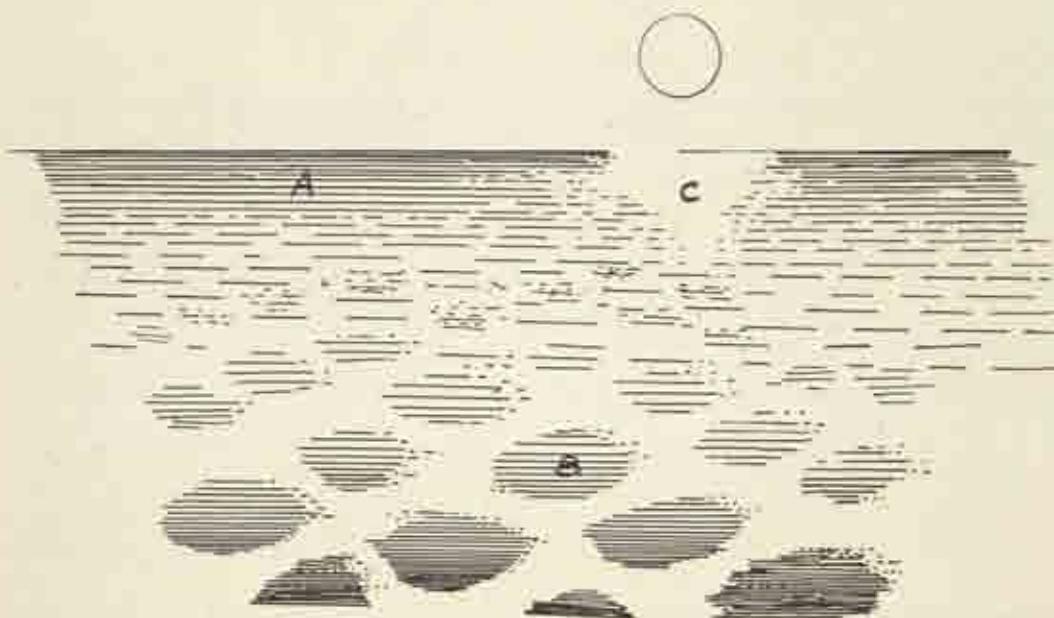
Fig. 114. Three Components in Water Surface

ground—darker distance (Fig. 114A). But for that portion of the surface that is at a sufficiently wide angle from the observer to enable him to see through it, the reverse applies, that is, the water appears darker in the foreground and becomes lighter as it recedes (B). This is more conspicuous when the surface is seen from a height. Where wave or ripple markings are present, the distance to which the effect can be seen is increased; the two effects, instead of fading into one another imperceptibly, as in a perfectly still surface, will be intercalated through

250

Fig. 115. Joseph Hecht: Norwegian Landscape, c. 1919. Engraving

the diminishing patches of the wave pattern. This is a statement of the simplest case. In practice, the source of illumination may be in front of the observer, when a total reflection will be seen where the wave surface is turned at a sufficient angle to the observer, constituting a third element (C); local reflections from objects near a margin may produce a fourth; but in each series a progression will be followed, except for the case of total reflection when almost no variation is perceptible.

Actually very successful compositions exist in which the finest work is in the foreground and the most violently contrasted blacks in the extreme distance, yet the construction and proportion of the plate keep the various elements unmistakably in their place. In such cases the values will count rather as local color than as variations of value on one homogeneous surface. This can be seen in the snow foreground of Hecht's *Norwegian Landscape* (Fig. 115), with its very fine engraving contrasted with the violent black silhouette in the distance: mechanically, the latter should appear in front of the former, but the composition keeps it in its place. In the same plate another device common to drawing and gravure is demonstrated. The foreground, though almost unworked, has apparent solidity, while the upper part of the plate is seen just as convincingly as unlimited space. Also by one of the simplest devices in gravure the snow foreground appears lighter than the sky, although in reality the two are identical in value. An unworked surface seen against blacks will appear whiter than the same surface alone or against grays.

But variations of value (light to dark) can of course be employed in drawing without any implication of color or texture. From the most subtle of these, the different qualities of "white" just referred to, to the qualities of black on black, the positive fact is that any uninterrupted succession will convey a recession. But just as with the accents described above, the succession may appear to have either the darkest or the lightest extreme nearer. This seems to apply equally to a clearly defined series of flat tones as to an imperceptible gradation. Certain associations with gradations seen in everyday life cannot be divorced from a change in value shown. A tone dark above to light below, even when a horizon is not shown, leads inevitably to the recognition of a sky, and the assumption of a horizontal earth plane below. But where, as in *Apocalypse III* (Fig. 15), the gradation is reversed, the conclusion will be either that a space is represented without the presence

252

SKY

↓

TO

GROUND

CONVEX

CONCAVE

SKY ↑

NO IMPLIED
BASE
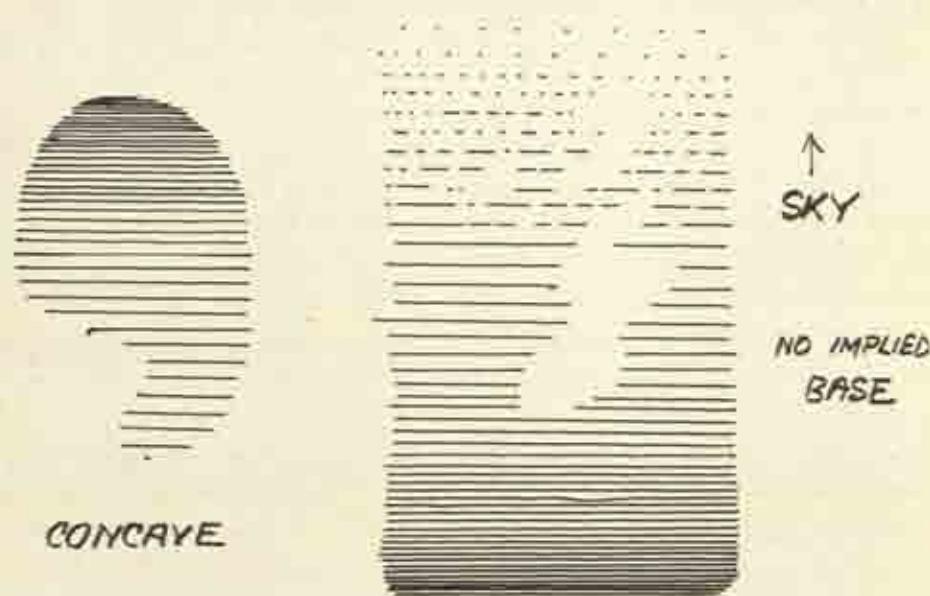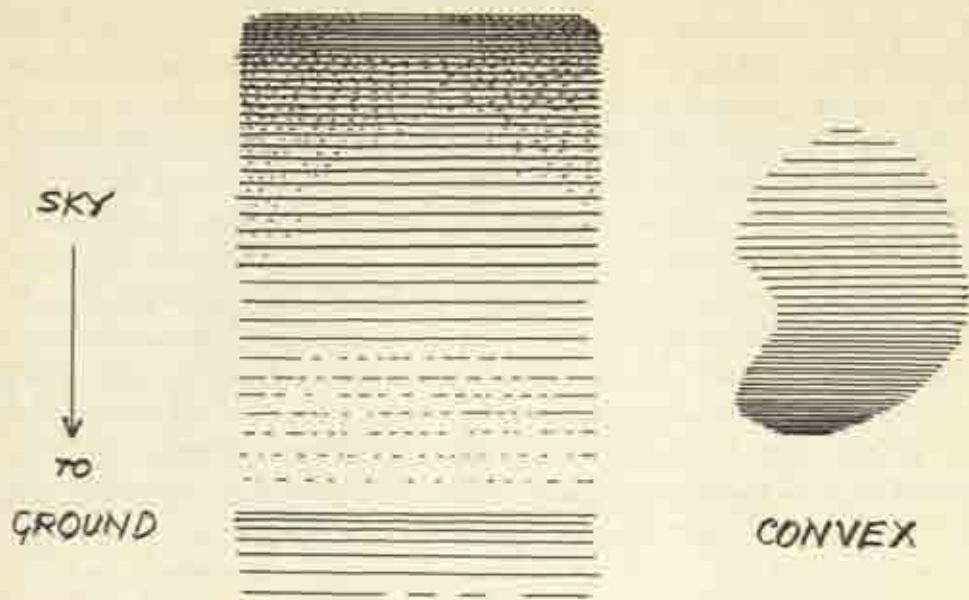
Fig. 116. Convex and Concave

of the earth or of gravitation, or movement in water (equally without gravitational consequence). If the print mentioned is turned upside down, I think this point will be clear.

Human beings stand erect, lighting is most generally from above, and vision proceeds bioptically in a horizontal plane. Thus a small volume of dark above will either be interpreted as concave, or as colored; with light above, it will be seen as convex (Fig. 116). To all these rules there are numerous exceptions, generally where the context plays a dominant role. Although we have tried to deal in this study with concrete quantities, yet the associations with different effects that have been developed by habit in the observer will influence his interpretation of the image. In fact, unless we take into account these associations as if they were concrete physical quantities themselves, we cannot employ the means of graphic communication *en connaissance de cause.*

CHAPTER

16

SPECIFIC QUALITIES - TEXTURES - PLASTER

We have seen that, by means of lines, textures and surfaces in metal plates adapted to retain ink and transfer it to paper, the artist has at his disposal all of the expressive qualities of drawing, and many of the possibilities of painting (where his textures replace the resources of color), and of sculpture, in his control over space, though with a definite limitation of scale. Together with these means— common to other forms of art—there exist a number of specific qualities realizable in the plate media, which are not completely shared with any other technique. These I will try to describe or at least indicate.

The engraved line

Those resources of expression by line described in Chapter 14 are realizable to a greater extent in the line engraved in a plate than by any means of drawing, or by any means of construction in wire fila- ment: in the first case it is necessary for the realization of the drawn function of the line to abandon the physical displacement character- istic of the wire construction, and in the second, the drawn character—
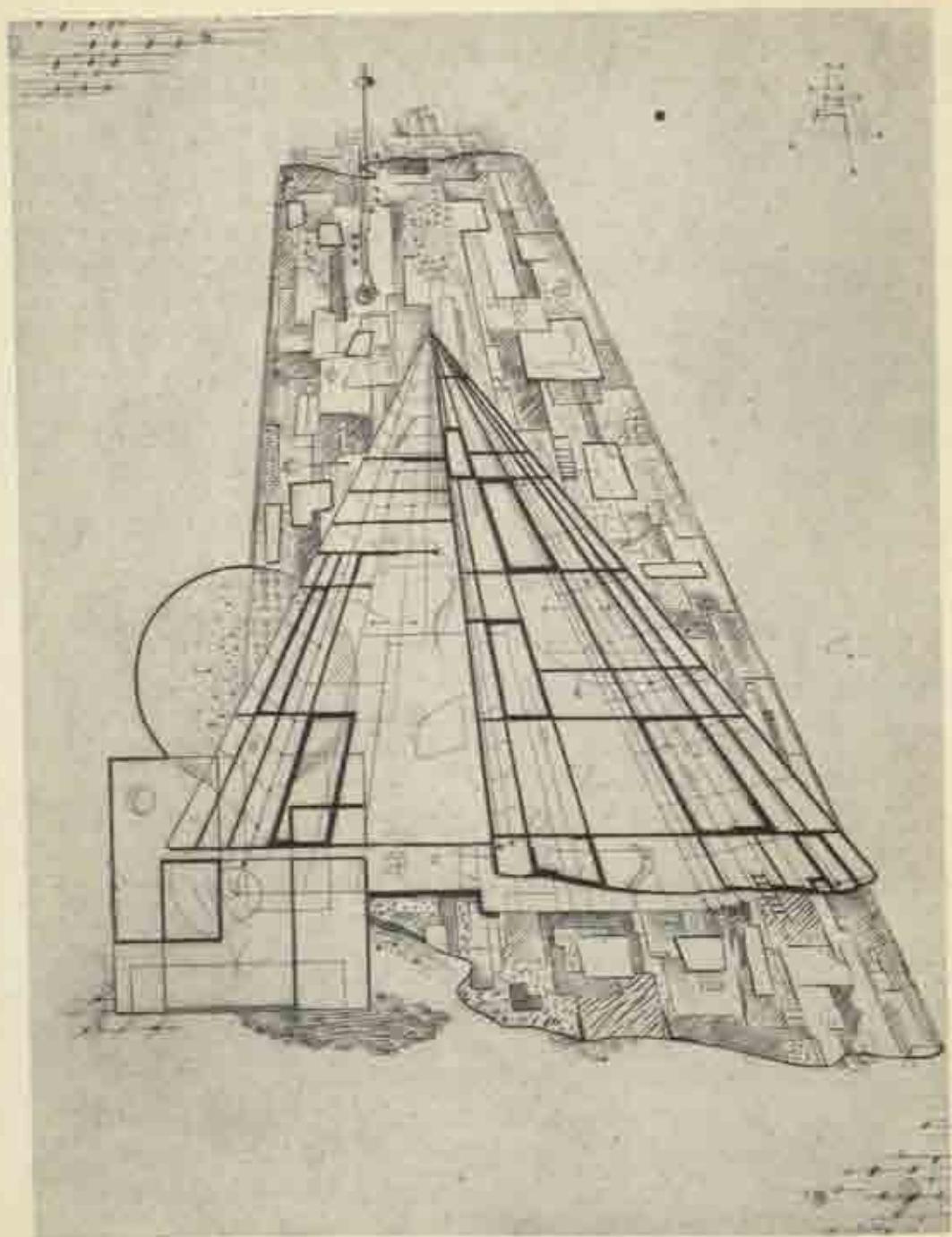
Fig. 117. Roger Vieillard: La Géométrie Organise le Chaos, 1939.
Engraving

Fig. 118. S. W. Hayter: Cronos, 1944. Engraving and Soft-Ground Etching
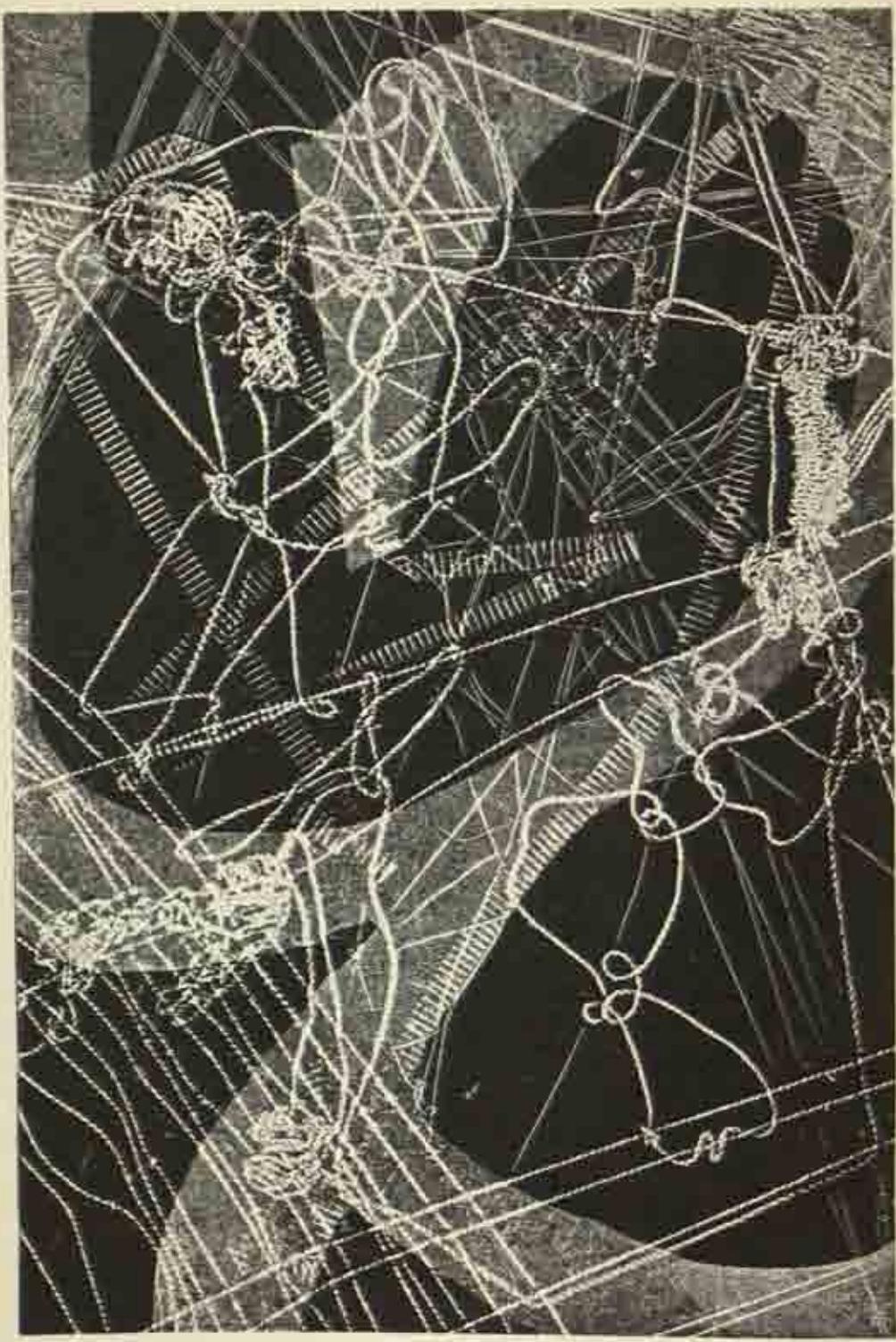
Fig. 119. Sue Fuller: The Sailor's Dream, 1944. Relief Print from
Soft-Ground Etching

that quality of apparent velocity of execution present in drawing—will disappear from the static result. In the mobile sculpture of Calder (Fig. 102) an element of velocity, a time function, referred to displacement along an involved but ultimately closed path, is added to the concrete space and implied motion of classical sculpture. But this does not correspond exactly to the impress of the velocities involved in the curvature of the trace of the burin in copper upon the printed line as detached from the plane of the proof upon which it appears.

But the most outstanding advantage of the engraved line is probably its function, either alone or in web-like systems of lines, of demonstrating an order of space having inherent curvature, its time function, its modification by the existence of tension and pressure, its disturbance by concrete objects, variation of density, or direction of flow—qualities which are not realizable physically in drawing or painting to anything like the same degree. In line, with the first initiative of Hecht following the early Italian engravers, it is the making of a concrete object in the plate—an object which is connected by resemblance and association with external objects or with the experience of phenomena, but unlike the normal uses of drawing has an independent existence apart from the description of the external phenomenon.

Textures

In the demonstration of density in space and recession by the use of superposed textures (of a different, a more neutral character than the web of engraved lines) the etching methods offer certain specific qualities. The practice I have observed with students who are first introduced to the possibility of transferring the quality of a texture to wax from which the acid will etch it into the metal, is to use such qualities in the manner of *collages* to decorate parts of the surface of their print. Normally they will fit such elements into a structure of lines already established in the plate. However, even at this point the overlapping of textures for the sake of using their transparency may be employed, as colored cellophane might be used in the *collage*. Already a certain specific quality of the medium is used: these disparate textures have been assimilated to one single matter, the etched trace in copper. Just as a photograph of disparate objects ends by being actually silver in a film, though in that case only that part of reflected light from the objects which could affect the emulsion is represented.
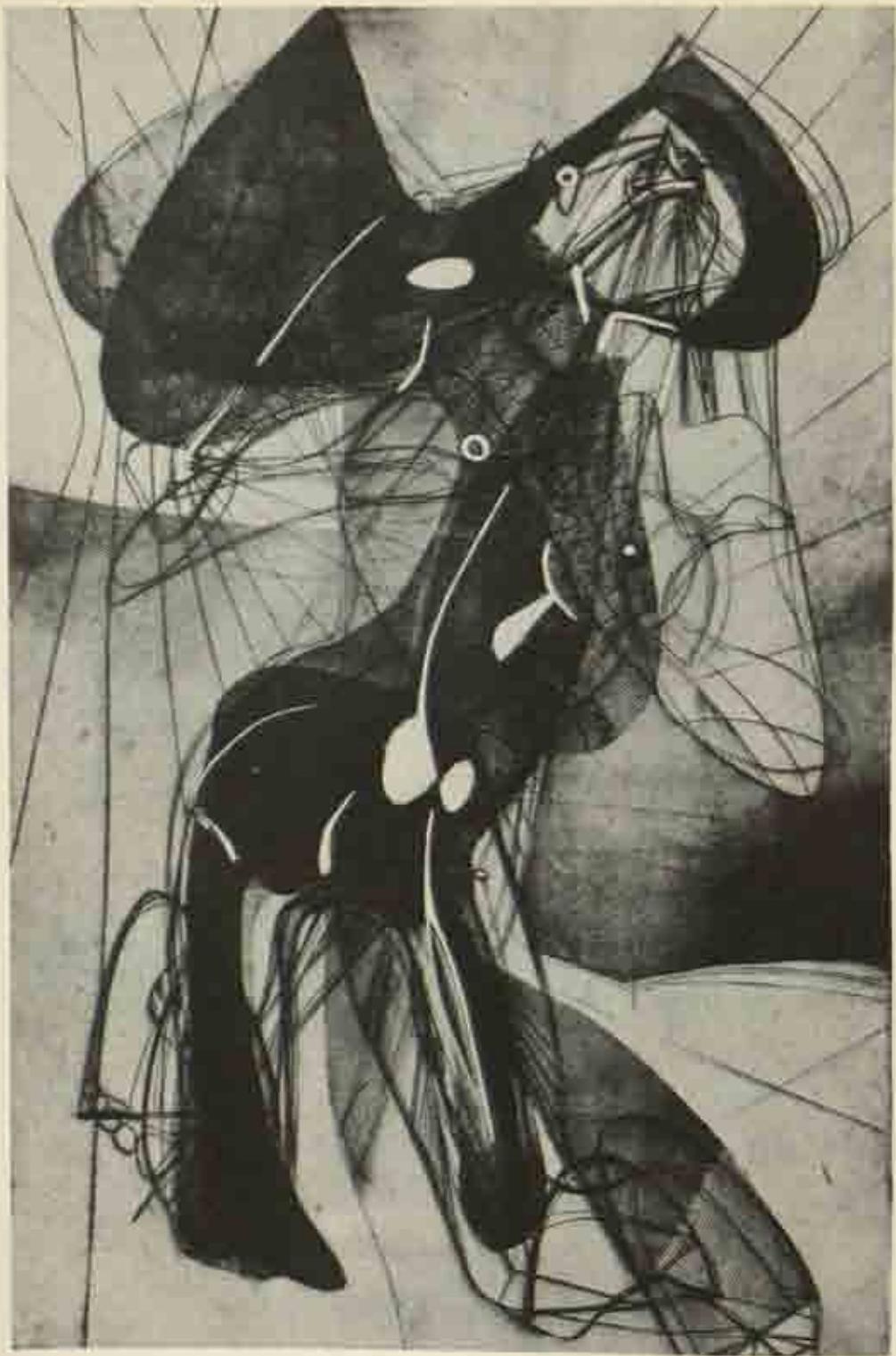
Fig. 120. S. W. Hayter: Amazon, 1945. Engraving and Soft-Ground Etching
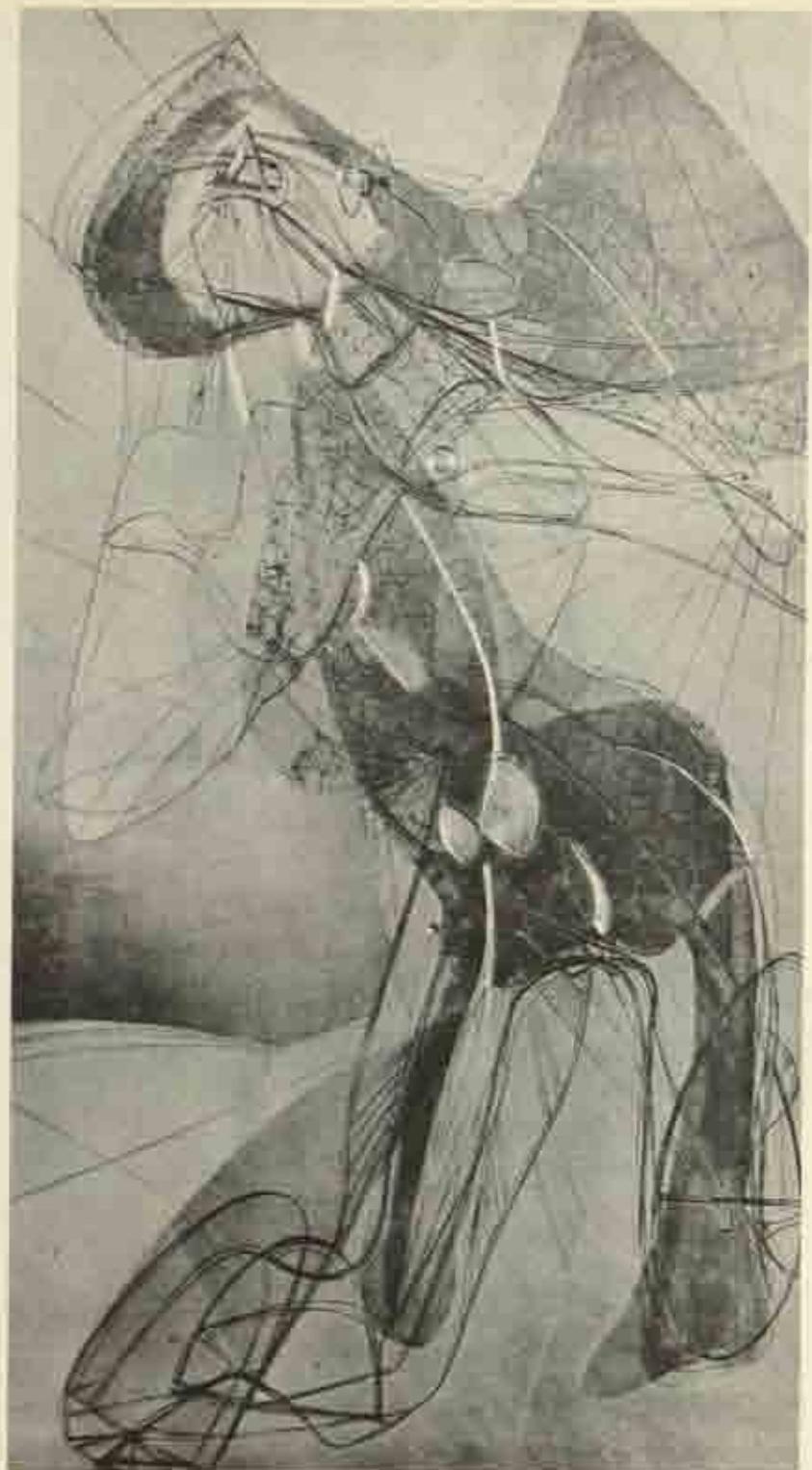
Fig. 121. Photograph of the Plate for the Print in Fig. 120

But the next stage in the employment of these textures is generally the realization that something has been wasted in getting profiles of textured areas to fit lines which already were there—in other words, instead of using each act of delimiting a surface for a positive constructive purpose, the act was merely made to emphasize and repeat a gesture already present in the plate. There generally follows the employment of the areas (still at this point flat and parallel to the apparent picture plane) in a sort of counterpoint, with linear elements allowing the former to function much more freely, and preserving the possible ambiguity of expression inherent in line, as creating further amplification and vibration by the play of their margins, volume, and relative position against the linear structure. Then by means of etching in gradation the web of a texture may be oriented in a plane diagonal to the surface of the plate—by actual torsion in the material a torsion of the space may be demonstrated. Interpenetration of several such elements may give rise to a space which can be interpreted in two or more ways. Sue Fuller made a plate in Atelier 17 in which all the lines that appear are the impressions of threads, some being in actual tension; there are no *drawn* lines in this plate (Fig. 119).

When a space possessing actual density is created by this means, its interpenetration by systems of engraved line (as distinct from the etched line which shares the physical character of the texture), two completely different orders of space can be brought into existence together.

Here I should add a note on our view of the probity of means in making plates. It has been a matter of "principle" in the past to insist on completing the whole of a plate by one means as bitten line, soft ground, aquatint or burin engraving, probably from a dim sense of preserving the unity of the result. I have never heard that a painting in one color, or executed with a single brush, was considered better in any respect than one done with complicated means. Integrity in the employment of the craft of etching and engraving implies that each means used shall be perfectly adequate to the function that it fulfils in the result—that under no circumstances shall the means be abused or sterilized to carry out a function for which another method is more appropriate. In fact the complexity of the means employed is completely unimportant if it is justified by the ultimate unity of the result—even should that unity result from deliberate incongruity.

262
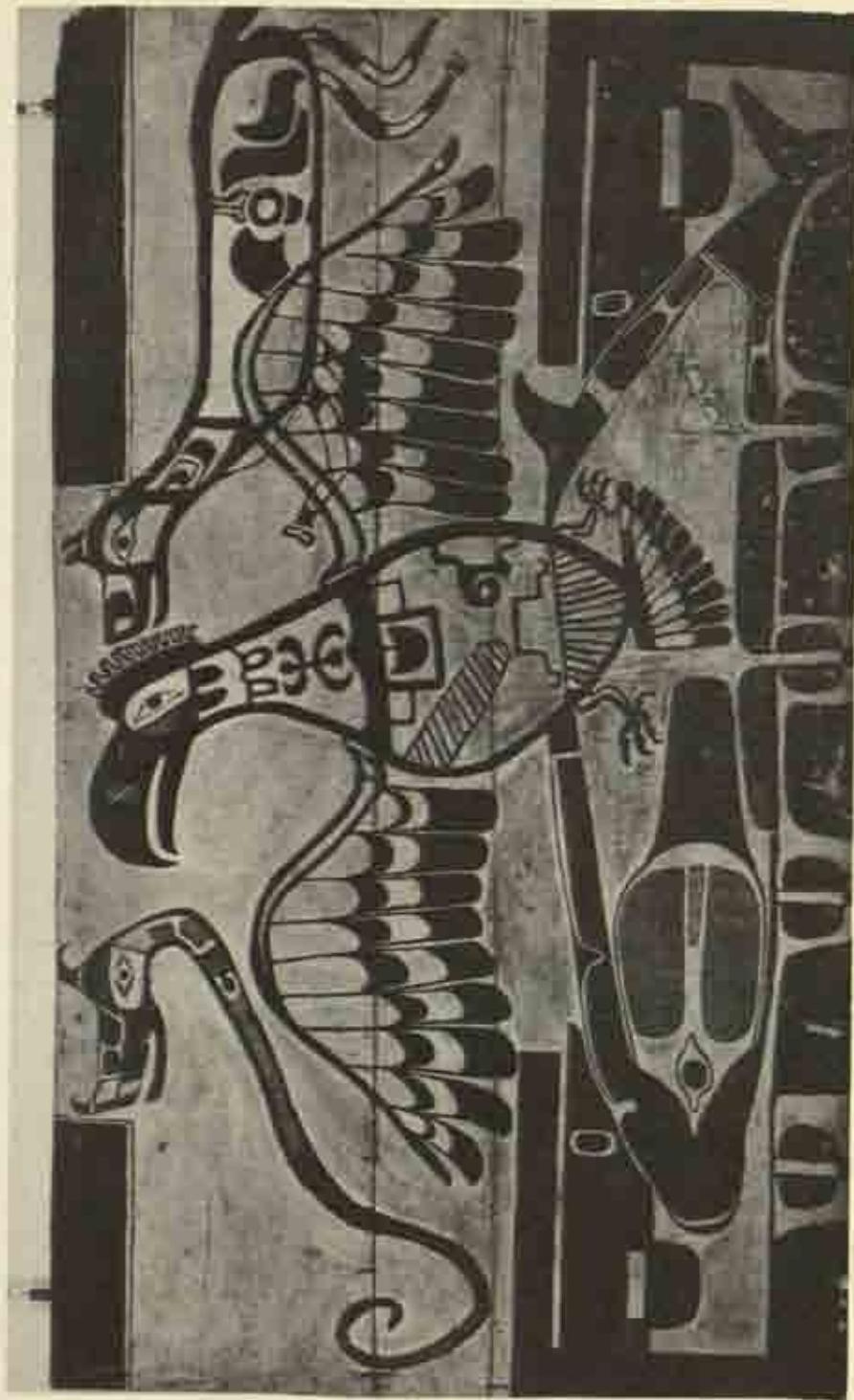
Fig. 122. Nootka: Wall Painting

The method of making an actual relief of the surface of the plate (and consequently of the proof) described in Chapter 4, associated with the peculiar effect that ink produces in printing from such plates, constitutes a general means of expression which is unique to the medium. Fundamentally this seems to depend on a contrast of varying density of black almost inevitably interpreted by the observer as a variation of light and shade describing a solid form; this exists side by side with a construction in physical space which is frequently contradictory of the first interpretation. Without returning to the fortuitous meeting of the umbrella and the sewing machine on the operating table of the Comte de Lautréamont, dear to the Surrealist, it seems that, in a different manner, the presentation of these physical incongruities does have the shock effect of breaking through the armor of use and wont of the observer, shaking his conviction in the sureness of his powers of observation and the inevitable banality of the result they deliver to him, and exposing the sensitivity of his spirit to the ideas we have to offer him. A technique which offers the artist these possibilities will be extremely precious.

In the somewhat peculiar method of making plaster reliefs (Figs. 60, 120, 121) by continuing to sculpt the block of plaster upon which an extremely low relief, as a print from an engraved or etched plate, has already been made, we have also certain specific possibilities which lie practically outside the normal resources of sculpture. Although the result could be described broadly as a species of polychrome sculptured relief, the peculiar means used to achieve the result does in practice produce a result which would not be conceivable if made entirely by the methods of sculpture. In the making of the plate, the cutting of the steel against copper if a burin is used, the biting of acid into metal if etched, determine a certain quality and scale. At the point where the print is made on the plaster the element of polychrome, or of black to white as light is added and a possible conflict between concrete space (in very small depth) and an apparent light/shade illusion arises. When the carving is commenced there is a further shift of scale (sculpture having a characteristically bigger scale than engraving), though the work will inevitably be conditioned by the result already attained. It is perhaps for this reason that, as I have mentioned in describing this technique, the adoption of either of these two methods which have

already contributed to the result—obvious physical displacement or light and shade interpreted as recession with a fixed illumination—will give a disappointing result. Actually, to a sensitive artist a certain logic will establish itself in working which depends on all those elements already established. The only existing art form in which I have seen such a quality is in some of the Alaskan and American-Indian polychrome reliefs and tissues (Fig. 122). Here the surface is divided into lenticular forms by grooves, and within these forms a concave shape leads sometimes to a deeper cavity, sometimes to a central convex form. It has been suggested that the motive in these cases was an obsession with the eye—that form being somewhat the form of an eye in an orbit—and the compulsion of these artists to make every form, which could possibly lend itself to such treatment, into an eye. We will not at this moment go into the metaphysical implications of this theory.

CONCLUSION

THE FUTURE OF GRAVURE

It may have occurred to the reader at this point that more importance has been given to questions of technique —which is often considered as a sort of mechanical process of execution of a work of art—than to the question of idea, of content, and significance of the final image. The reason for this apparent overemphasis, apart from the fact that technical matters are more readily described in words than graphic ideas, and the author's view of the function of technique in contributing to a result, certainly do need to be defined.

It has seemed to me that the arbitrary separation of the eye and the imagination in "creating" the image, and of the hand and the more or less logical processes of the mind in executing the work, is very difficult to defend. Thus the custom of separating the different functions of the individual into spiritual, emotional, physical, etc., has a certain convenience in considering these functions, but can lead to the most absurd error if one loses sight of the integral character of the being exercising them. In the numerous processes of gravure where the mechanical complexity of some of the operations, and their reputed difficulty (generally exaggerated, in my opinion), might appear to hamper the development of expression, I consider that the very complexity of

266

Fig. 123. André Racz: Medusa, 1945. Engraving and Soft-Ground
Etching

the means can be applied to provoke it. Thus the antithesis between inspiration (imagination-unconscious) and execution, in the view of our group, has no real existence. The possession of a means of execution has in our experience, even in the case of mature artists whose general field of image is already developed in a definite direction, led to the stimulation or activation of further and different areas of imagination which were previously dormant.

An example might make this point clearer. In a technique elaborated by André Racz for certain of his plates, in particular in *Medusa* (Fig. 123), the artist drew automatically with a sort of viscous gesso from a container upon a sheet of smooth board. When completely hard, the varying relief of thicker and thinner traces was reduced with sandpaper to a minimum. A copper plate was then coated with soft ground and the board pressed into it. When removed, the ground was lifted to expose the copper along the lines, and in weaker areas in the wider spaces of the background owing to the flexibility of the board; the ground remaining intact only in continuous traces along the exposed lines. Certain areas, consequent upon the traces already established, were covered with stopping varnish, to be white in the final result. The plate was then etched very accurately with the chlorate bath. Later, engraved passages were added with burin, opaque dark areas bitten in aquatint, again consequent upon the previous image, and some hollows removed with scorpers to print white, and in relief above the remainder of the print surface.

Now it is difficult to imagine a more absurdly remote process to produce a black image on a white sheet. But the magical quality of the result depends here on the very remoteness of the method. At the first stage in the handling of the gesso the intention and choice of the artist is exercised—note that this image is in the same direction as the print, reversed in the plate; in stopping-out the transferred image a further choice is made: the action of the acid is controlled to select those accidents of pressure and intensity that could favor the latent image. In the engraving, the aquatint and the development of the white accents, at each point the artist exposes his image to accident—but accident that can be dominated by his intention. No consciously organized execution of a previously conceived plan could have given as powerful an emotive image, nor could it have produced its richness and completeness of quality. Yet without a planned succession of operations based

Fig. 124. Mauricio Lasansky: Sol y Luna, 1944. Engraving and Soft-Ground Etching

on previous experience it could not have been done. Thus, in the mechanical use of a technique, only those qualities previously experienced by the artist can appear in the result—the making of the particular plate will not necessarily enrich his experience, nor will it provide him with means which he did not already possess. This is not art as experience, it is art as the journalism of experience.

It is in the exposure of his idea and his plate to the accidents of a method, to the imminent risk of destruction, that the greatest result may occur in the work and the most valuable experience in the artist. I would suggest that the courage needed to adventure in this manner, as much as the oft-quoted infinite capacity for taking pains, may be a component of genius, and may distinguish the valid artist from the hack.

After twenty years of contact with artists working in experimental media of gravure, and my own work in this field, I consider at this point the first essential to undertaking a plate or other work of art a powerful urge to make a latent image visible—together with a consequent delight in the image. Beyond this, the access to the image-making faculty of the mind, the ability to free oneself during the development of an idea from considerations of mode, profit, the possible effect of one's work upon the observer, a certain courage to follow the development wherever it may lead without editing, formalizing, or modifying it with respect to any but the implicit requirements of the growing design, whether absurd or not, all seem to me equally important, once the first incentive is assumed. The source of such incentive has been very much debated; it is extremely difficult to identify if one seeks the ultimate source—though the superficial circumstances may vary widely. Thus I have known artists ascribe their productive state to tactile sensation, sleep, exhaustion, ill-health, internal conflict, fury, relaxation, reading, music, stimulants, violent motion, complete passivity, among other states. Any of these, from their diversity, would appear to be an individual idiosyncrasy leading to the functioning of a single underlying cause, which I would not attempt to define further except for the suggestion that among the main movements of the human spirit it be sought with the instinct of play rather than that of work (as struggle for subsistence). Not that I would consider such a source to be trifling or unimportant—but it is certainly in line with the gratuitous character of artistic activity.

In most of the cases I have observed, the elaboration of an idea in a

270

plate (and in many other media of expression) follows a certain succession of stages which, whether longer or shorter, are nearly always present—somewhat like the organic elaboration of growth in a plant. The first attack in the plate is rapid and without great difficulty or hesitation up to a point when one generally needs to make a print to verify what has been achieved (First State). At this stage the result will often be spontaneous and vivid but definitely inadequate. (Frequently far less appears on the plate than one anticipates, as the mind has projected more than the hand has recorded.) Already the reciprocal effect of execution $\leftrightarrows$ imagination will generally decide the next stage in the development of the design. The first strokes on the plate set up a train of consequences like the ripples from a stone dropped into a still pond, and the factor of experience in the artist determines the number and succession of possible consequences offered to his choice, just as a master of chess can visualize, from an opening, a great number of moves to a mate while a beginner can see only a few immediate moves. In my own manner of working I would consider the selection among these consequences rather to be unconscious than deliberately conscious, and in no case mechanical. This stage in the development of a plate may be marked by a shift in medium from, for instance, burin line to bitten surface, and in this case it would seem to me preferable to employ counterpoint rather than to conform to the linear design already established. Thus the possible mutations between profile of bitten surface and line would be at a maximum—in other words, far more consequences will offer themselves at the next stage than if biting had conformed to previous linear design. From this second state, once the definite choice of direction has been made, progress is fairly simple, though frequently it becomes necessary to make another very bold transformation when the design seems to freeze. The last stage generally in my own plates would be the addition of white relief accents; this often needs long reflection, until their form and their position in relation to work already done and to one another become clear. Another concluding stage which often is used for the re-simplification of a design which has become over-complicated is to etch away large areas of the work, thus separating the parts to be retained from the background at a different level. Then, almost always, a very few touches will be needed to complete a plate; this may prove to be a third point of great difficulty as it may require days of study of the

image before the inevitable position of these touches establishes itself.

To work in this manner it is clear that complete familiarity with the medium and its possibilities has first to be acquired; latterly I have tried to direct students to make experimental plates which are worked to destruction. At any point when an interesting result has been achieved a few prints may be made to keep, but the plate is then continued and finally destroyed. This we have found valuable in forming an attitude to the work in which a partial or incomplete result will not be accepted for fear of destroying the plate, and a consciousness of the power to add, remove, correct, or develop elements to any degree is cultivated. This familiarity with the medium permits a reasonable succession of operations to be foreseen (practicable in the order designed) although the artificiality of the consciously planned and fabricated result is avoided. Thus a transformation which makes of a secondary or consequent structure the final theme of the plate is possible without loss of control.

Perhaps this account will make clear my point about the attitude of play in elaborating an idea as distinct from the mechanical and repetitious execution of a frozen scheme by the methods of work. As I see it there is no lack of seriousness in this attitude—what could show greater seriousness and concentration than a child playing an elaborate game? The acquisition of means in the plate media, the enriching of the artist's experience can only occur as he plays with his processes with a certain detachment from the result; the painful and accurate execution of a preconceived plan can only involve those means already familiar to him, and offer no new ones. I feel that in undertaking any graphic work the artist places himself in a position to allow miracles to happen to him, even though the position involves risk, but he must retain a certain alertness, a kind of awareness, or the miracle will happen when he is not present.

The artist uses the oldest traditional tool of the printmaker, the burin, to cut furrows through a surface of copper to different depths so that threads of ink shall stand up above the sheet in the print at different heights. The simplicity of curvature, due to the two components of the driving pressure and the resistance of the metal, and the aspect of the mind of the artist following the moving trace in a space which is continually changing with the rotation of the plate—all this might be thought to hamper the expression. But in another sense these are fac-

tors to provoke his imagination, and to free him from the banal associations of the drawn trace. Again the very indirectness of the method, the inversion of the image from left to right, of his space from depth to height, the reversal of the normal relation of the fixed observer to the line that moves, so that the artist seems to go with the burin point,

Fig. 125. Jan van de Velde (1593?–?1641):
Initial "I." 1605. Engraving

can open new territory to him. In this connection I would like to note that in my opinion even in our group no more than a very small fraction of the possibilities of these methods has been exploited. With longer acquaintance with the means artists will probably develop a much finer sensitivity to tension, rhythm, play between line and point, and drift in curved space.

In the decorated initial of Van de Velde (Fig. 125), as in the elaborate exercises of the writing masters, I think the reader will agree that no line, even by accident, has a powerful expressive or emotive function. Now from what has already been said, it seems that somewhere among these burin traces at various depths, their intersections and consequences—all those qualities leading to the most expressive use of the medium—by accident the magic quality of the work of the tool should have manifested itself. Perhaps the future will show what it is that a burin can do to an artist, or an artist to a burin, to achieve this complete sterilization. The definition of this point would be a most valuable gain in a negative sense, as of a thing to be avoided. Perhaps one might suggest that the inaptitude in the engraver to recognize the

miracle contributes to this result, so that the physical appearance of the phenomenon is made impossible, or perhaps that, the focus of attention of the artist being elsewhere—upon execution, virtuosity, decorative effect—its development was prevented.

From the technical point of view it is possible that in the future a much wider application of the direct engraved or etched work of the artist will be made to the methods of mass printing at low cost. By "direct" I refer to precise mechanical methods of reproduction rather than photographic means to transfer the appearance of an engraved print to the final printing surface. The printing by ordinary typographic means of illustrations in cheap editions from the artist's own original metal cuts (rather than from line or half-tone cuts made photographically from them) could have an enormous development if enough artists with the technical competence to make the plates could be found, and if printers and photoengravers could be persuaded to take a reasonable view of this activity. The public, given the opportunity, would learn very readily to distinguish the finer quality of such work.

With the increasing use of offset for fine work it might be interesting to generalize the experiment made by the Curwen Press in England about ten years ago in which a wet proof of an engraving was transferred without the intervention of photography to a lithographic surface, from which it could be printed either directly or by offset. The accuracy of the reproduction was perfect, except of course for the loss of relief above the print surface. However, with the increasing use of intaglio methods of printing on paper (rotogravure) and on fabrics (solid-deposit printing), it will become possible to print from the actual engraved surface of the artist's plate, formed into the roller accurately enough for the ductor blade to clear it, or possibly by means of an accurate mechanical reproduction on a cylindrical surface (electrotype method proposed in Chapter 8). It is true that the normal depth of "etch" in a rotogravure cylinder is only a few thousandths of an inch while the depth of the engraved line may be several hundredths, but the electrolytic redeposition of spongy copper into these lines, the surface being protected with a "resist," could overcome this difficulty.

For this result to be attained it would first be necessary to convince such people as the owner of the best-equipped newspaper in New York, and one of the most successful publishers (both of whom have been

consulted at certain moments) that what is now being offered to the public is not, as they claim, already too good for them to appreciate. Perhaps commercial artists will free themselves from the inherent contradiction of their title and become sufficiently familiar with the elements of the printing processes, on which the reproduction of their works depends, to be able to compose directly in those processes, instead of employing the ingenuity of photographers to break down their sketches and the industry of printers to put them together again. After all, this is no more than what is demanded of the "fine" artist working in the print media for less reward.

The relations, historical, actual and potential, between the arts of original gravure in the hands of the artist and the numerous efficient methods of mass printing which have developed from them can hardly be dealt with here. Another work of greater size would be needed to cover this very interesting subject, but in passing one might reflect that the knowledge, even the actual practice, of such "primitive" crafts could be of great value to those in charge of the application of the elaborate machine printing systems. Such a study could even make for a freer and bolder use of such equipment, frequently neglected because of the conventional formation and restricted graphic education of people in such positions.

To leave the possible methods of vulgarization and multiplication of the results of the engraver's art, I hope that this book has succeeded in demonstrating the importance and richness of the long-neglected means of expression inherent in the plate media; that its technical information will be of use to artists bold enough to undertake adventure in printmaking; and that some of the speculations in the concluding section will provoke artists to experiment in directions which we have not yet foreseen.

26/774